EG&G
ENERGY MEASUREMENTS

EGG 10282-2080

RESULTS OF PRECONSTRUCTION SURVEYS USED AS A MANAGEMENT TECHNIQUE FOR CONSERVING ENDANGERED SPECIES AND THEIR HABITATS ON NAVAL PETROLEUM RESERVE #1 (ELK HILLS), KERN COUNTY, CALIFORNIA

by

Thomas T. Kato, Thomas P. O'Farrell,
and Jeffery W. Johnson

AUGUST 1985

This report is unclassified: Hy Borella
Classification Officer

Work performed for the U. S. Department of Energy,
Office of Naval Petroleum and Oil Shale Reserves,
and Chevron U.S.A., Inc., through the Nevada Operations Office
under Contract No. DE-AC08-83NV10282.

SANTA BARBARA OPERATIONS
130 ROBIN HILL RD., GOLETA, CALIF. 93117

ABSTRACT

In 1976 an intensive program of petroleum production at maximum efficient rate was initiated on the U. S. Department of Energy's (DOE) Naval Petroleum Reserve #1 (Elk Hills) in western Kern County, California. In a Biological Opinion required by the Endangered Species Act, the U. S. Fish and Wildlife Service concluded that proposed construction and production activities may jeopardize the continued existence of the endangered San Joaquin kit fox, *Vulpes macrotis mutica*, and the blunt-nosed leopard lizard, *Gambelia silus*, inhabiting the Reserve.

DOE committed itself to carrying out a compensation/mitigation plan to offset impacts of program activities on endangered species and their habitats. One compensation/mitigation strategy was to develop and implement preconstruction surveys to assess potential conflicts between proposed construction activities, and endangered species and their critical habitats, and to propose reasonable and prudent alternatives to avoid conflicts.

Ground transects were walked by trained observers who examined the proposed project sites for evidence of endangered species. If potential conflicts were observed the wildlife biologists worked with personnel from the Construction and Environmental Affairs departments to develop compromises that achieved both construction goals and conservation of the endangered species.

Between 1980 and 1984, preconstruction surveys were completed for 296 of a total of 387 major construction projects encompassing 3590 acres. Fewer than 22% of the projects potentially conflicted with conservation of endangered species, and most conflicts were easily resolved by identifying sensitive areas that required protection. Only 8% of the projects received minor modification in their design or locations to satisfy conservation needs, and only three projects had to be completely relocated. No projects were cancelled or delayed because of conflicts with endangered species, and costs to conduct preconstruction surveys were minimal.

The successful implementation of preconstruction surveys as a technique for conserving endangered species and their essential habitats in the midst of a major petroleum development program was due to: 1) initiation of the preconstruction survey program before each element of the construction project resulted in destruction of habitat, 2) concurrent support of a research program to develop essential information to guide

and modify the techniques and decision matrix, and 3) maintenance of an effective working relationship between the wildlife biologists conducting the preconstruction surveys and the staffs of the Environmental Affairs and Construction departments charged with carrying out the major construction activities.

ACKNOWLEDGEMENTS

We wish to acknowledge the following EG&G staff members whose diligence and efforts contributed to the development of a successful preconstruction survey program: B. G. Evans, D. B. Hardenbrook, C. E. Harris, B. T. Kelly, N. E. Mathews, P. M. McCue, J. S. McManus, P. A. Medica, P. C. Muick, and M. L. Sauls.

Dr. R. Lee Norland, Senior Environmental Specialist, Williams Brothers Engineering Company, provided crucial information on new construction projects and served as liaison with other Unit Operator departments.

Mr. Van Foster, Mr. John Hill, and Mr. Ernie Wilcher, Williams Brothers Engineering Company Construction Department, were instrumental in making the preconstruction survey process feasible and successful.

CONTENTS

ILLUSTRATIONS

ILLUSTRATIONS (continued)

TABLES

1. INTRODUCTION

1.1 BACKGROUND

The U. S. Department of Energy's (DOE) Naval Petroleum Reserve #1 (NPR-1) is located in southwestern Kern County, California, approximately 30 miles southwest of Bakersfield and about 100 miles north of Los Angeles (Figure 1). NPR-1 encloses most of the Elk Hills, which are low foothills of the higher Temblor Range to the south and west. NPR-1 (also referred to in this report as "Elk Hills") has had a modest but continuous drilling and petroleum production program since 1919. However, in 1976 a new intensive program of production at maximum efficient rate (MER) was mandated by Public Law 94-258 to increase national oil production (U. S. Department of Energy, 1979). Construction of well pads, roads, and pipelines was greatly expanded, and a gas separation and compression plant, bulk storage facilities, water flood injection system, pumper electrification network, cathodic protection system, and related new facilities were proposed. When MER is completed the amount of land disturbed will equal the amount developed between 1919 and 1976 (U. S. Department of the Interior, 1980a).

In June 1979, the regional office of the U. S. Fish and Wildlife Service (FWS), notified DOE that proposed construction activities on Elk Hills required a formal consultation owing to their potential impacts on two endangered species, the San Joaquin kit fox *(Vulpes macrotis mutica)* and blunt-nosed leopard lizard *(Gambelia silus)* (U. S. Department of the Interior, 1979). Both are protected under the Endangered Species Act of 1973 (Public Law 93-205) which requires Federal departments and agencies to carry out programs for the conservation of endangered species on their lands, and to insure that their actions do not jeopardize the continued existence of such endangered species or result in the destruction or modification of habitat critical to their existence. Habitat on NPR-1 represents a significant proportion of the extant critical habitat for both species (Brode et al., 1980; O'Farrell, 1983).

DOE sponsored field studies in 1979 to assess the biological consequences of Project 12, a proposed liquified products pipeline (LPP) and a storage and railroad loading facility (SRLF) on endangered species and their habitats (Madrone, 1979ab). Project 12 was one of the early stages of complying with MER. In October 1979, DOE requested a formal consultation with FWS pursuant to Section 7 of the Act to obtain a Biological Opinion concerning the impacts of Project 12 on endangered species and their habitats. Consultation regarding the remaining

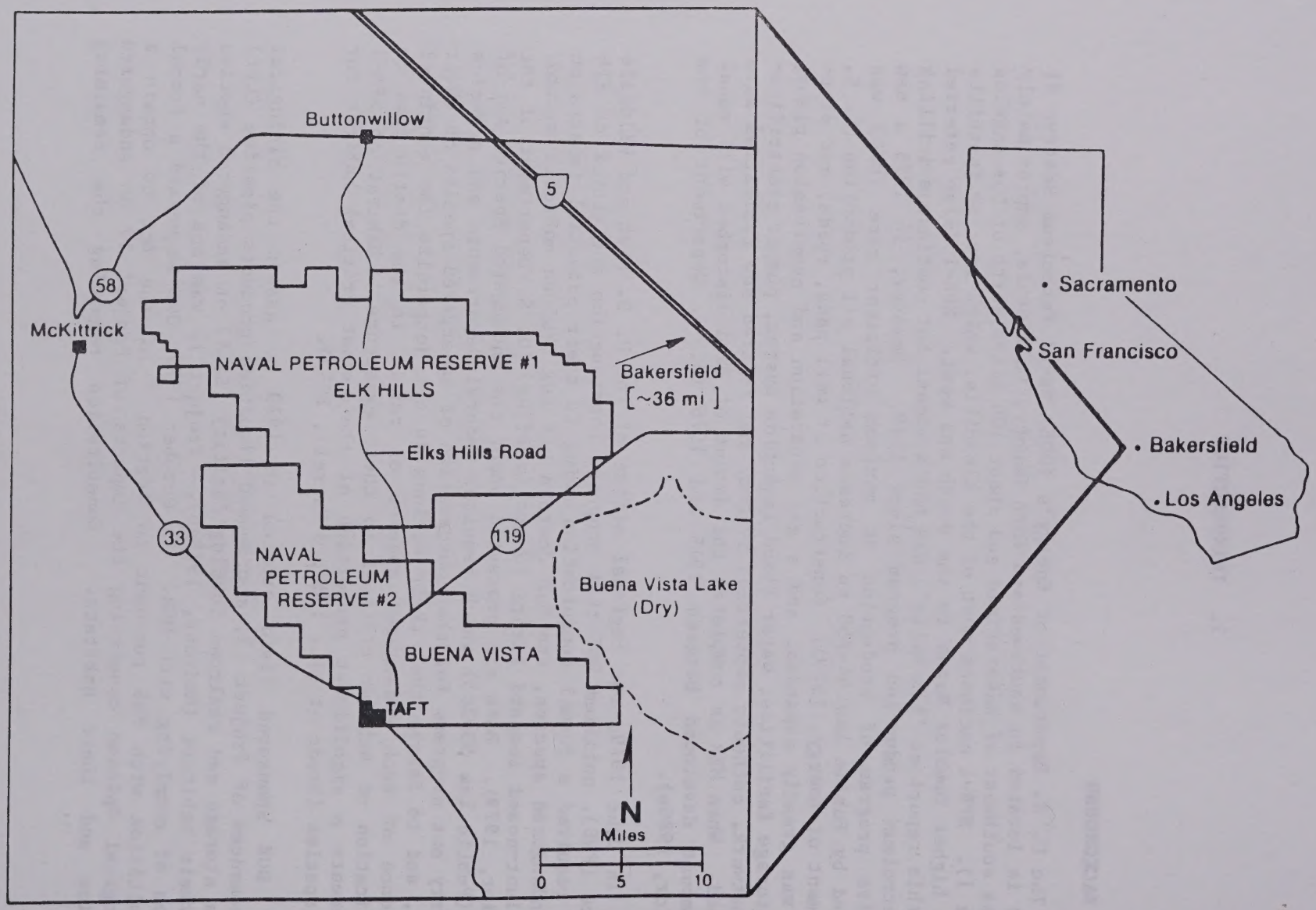

Figure 1. Location of U. S. Department of Energy's Naval Petroleum Reserve #1 (Elk Hills), Kern County, California.

activities on Elk Hills was projected for late in 1980 or early 1981. However, in February 1980, FWS chose to consider the cumulative impacts of all proposed Elk Hills construction activities, including Project 12, and concluded that the overall impacts anticipated under Public Law 94-258 may jeopardize the continued existence of the San Joaquin kit fox, blunt-nosed leopard lizard, and their critical habitats (U. S. Department of the Interior, 1980a).

In their Biological Opinion FWS proposed reasonable and prudent alternatives to avoid jeopardy to both species, while allowing DOE activities to continue concurrently with mitigation (U. S. Department of the Interior, 1980a). These alternatives included:

1. A commitment by DOE to conduct studies on endangered species for at least three years.
2. Preparation of a Master Plan to guide completion of MER activities that would include consideration of endangered species.
3. Preparation of a Master Plan for the restoration of disturbed habitats.
4. A DOE commitment to the carrying out of a compensation/mitigation plan to offset impacts of MER on endangered species and their habitats.
5. Designation of a qualified individual as Environmental Coordinator to supervise endangered species matters.
6. A seven-point program to mitigate possible impacts of Project 12.

In April 1980, the Director, Office of Naval Petroleum and Oil Shale Reserves (ONPOSR), committed DOE to comply with the required mitigation/compensation measures if some of the wording in Requirement 4 was modified slightly (U. S. Department of Energy, 1980). FWS accepted the change in June (U. S. Department of the Interior, 1980b).

Destruction and disturbance of critical habitat represented the most significant negative effect on endangered species as a result of proposed DOE activities on NPR-1. 40 CFR 1508.20 states that mitigation should include avoiding the impact altogether, or minimizing impact by limiting the degree or magnitude of the action and its implementation. 50 CFR 424.02 includes maintenance of habitat as a part of a conservation program for endangered species. However, a potential problem existed, since construction activities were allowed to take place before the results of field studies provided essential management guidelines to conserve the species. It was likely that large areas of habitat would be lost before an adequate biological assessment could be completed, because so little information on the ecological requirements of the species was available in 1980.

1.2 GOAL

The major goal of this program was to develop a strategy to minimize these losses by developing and implementing preconstruction surveys to assess potential conflicts between proposed construction activities and endangered species and their critical habitats. Specific goals were to: 1) use available information on ecological requirements of the species and construction requirements associated with MER to develop techniques for conducting preconstruction surveys to mitigate impacts on endangered species; 2) implement preconstruction surveys prior to any habitat disturbances; 3) assess the potential impacts, both positive and negative, of construction activities on endangered species and their habitats; 4) help the Unit Operator develop reasonable and prudent alternatives to proposed activities that potentially threaten endangered species and their habitats; 5) evaluate the effectiveness of preconstruction surveys as a continuing mitigation strategy; and 6) transfer responsibility for the conduct of preconstruction surveys to the Unit Operator if the technique proves to be successful and operating guidelines can be developed.

While this project was underway FWS notified the Director, Naval Petroleum Reserves in California (NPR-C), that the giant kangaroo rat *(Dipodomys ingens)* was being reviewed to determine whether it deserved federal protection as an endangered species. They suggested that DOE might want to cooperate by initiating a conservation program for the species because its listing was highly likely and it was known to occur on NPR-1 and the adjacent NPR-2. A secondary goal of the preconstruction program was to gather information on potential impacts of MER activities on giant kangaroo rats and to include them in mitigation strategies.

1.3 DESCRIPTION OF ELK HILLS

NPR-1 includes 47,245 acres in townships Z (T30S, R22E), R (T30S, R23E), S (T30S, R24E), T (T30S, R25E), B (T31S, R23E), G (T31S, R24E), and M (T31S, R25E). Approximately 20% of the Reserve is privately owned by Chevron U.S.A., Inc. Elevations range between 290 feet above sea level on the valley floor at the northeastern boundary near Tupman, and 1551 feet at Hillcrest Point along the western portion of the main ridge. The general topography is characterized by many gently rounded divides and smooth slopes. Numerous ephemeral streams drain the hills and have created a highly dissected pattern of gullies and channels. Sediments deposited along the base of the hills form a gentle piedmont alluvial plain that leads into the adjacent valley lands.

Surface soils are generally a loose, light-colored loam or sandy-loam containing few rock fragments. Well vegetated surface soils are usually nonsaline and nonsodic, but subsurface soils may have higher salt concentrations.

The climate is typical of a semiarid region having hot, dry summers and cool, mild winters. The average maximum summer temperature is 95°F, and temperatures of 100°F or more are common. Average maximum temperature in winter is 62°F and the average minimum temperature is 40°F. Mean annual precipitation is typically less than six inches, but heavy winter ground fogs provide additional, unmeasureable moisture.

Vegetation of Elk Hills is characteristic of Valley Grassland (Heady, 1977) surrounding the agricultural lands of the San Joaquin Valley. This vegetation type is characterized by few or no trees, scattered shrubs, and a herbaceous ground cover composed primarily of annual plants. Dominant ground cover species include the annual grass red brome *(Bromus rubens)* and red-stemmed filaree *(Erodium cicutarium)*. Despite the monotonous appearance of the vegetation, many species of grass and forbs occur on Elk Hills. Other common annuals include such species as foxtail fescue *(Festuca megalura)*, wild oats *(Avena fatua)*, slender oats *(Avena barbata)*, Arabian grass *(Schismus arabicus)*, peppergrass *(Lepidium dictyotum)*, larkspur *(Delphinium gypsophilum)*, fiddleneck *(Amsinckia* sp.), and owl's clover *(Orthocarpus purpurescens)*.

The most common shrub is desert saltbush *(Atriplex polycarpa)* which occurs throughout the Reserve. Other locally common shrubs include cheesebush *(Hymenoclea salsola)*, bladderpod *(Isomeris arborea)*, matchweed *(Gutierrezia bracteata)*, spiny saltbush *(Atriplex spinifera)*, winterfat *(Ceratoides lanata)*, and buckwheat *(Eriogonum fasciculatum)*.

Twenty three species of mammals have been observed including: black-tailed jackrabbits *(Lepus californicus)* and desert cottontails *(Sylvilagus audubonii)*, the most commonly observed mammals; San Joaquin kit fox and coyotes *(Canis latrans)*, the most common carnivors; badger *(Taxidea taxus)*; bobcat *(Felis rufus)*; long-tailed weasel *(Mustela frenata)*; and an occasional gray fox *(Urocyon cinereoargenteus)*. The giant kangaroo rat and Nelson's antelope ground squirrel *(Ammospermophilus nelsoni)* are two of the 11 species of rodents known to occur on NPR-1. The former is being considered by FWS for federal protection as an endangered species and is considered to be endangered by the State of California; the latter is considered to be rare by the State (State of California, 1980).

Of the 60-70 species of birds recorded, the most commonly observed are California quail *(Callipepla californica)*, mourning dove *(Zenaida macroura)*, logger-head shrike *(Lanius ludovicianus)*, and the western meadowlark *(Sturnella neglecta)*. Conspicuous raptorial birds include the red-tailed hawk *(Buteo jamaicensis)*, golden eagle *(Aquila chrysaetos)*, and American kestrel *(Falco sparverius)*.

Reptiles commonly observed on NPR-1 include the side-blotched lizard *(Uta stansburiana)*, western whiptail lizard *(Cnemidophorus tigris)*, blunt-nosed leopard lizard, western rattlesnake *(Crotalus*

viridus), gopher snake *(Pituophis melanoleucus)*, and San Joaquin coachwhip *(Masticophis flagellum)*.

The only known amphibians are the western toad *(Bufo boreas)* and Pacific tree frog *(Hyla regilla)*.

1.4 RESPONSIBILITIES

Although NPR-1 consists of a mixture of DOE and Chevron property, control of the Reserve was vested in the Secretary of Energy by a Unit Plan Contract negotiated with Chevron in 1942. The Secretary of Energy acts through the Director, NPR-C, to accomplish DOE goals on NPR-1. The Unit Plan Contract also established an Operating Committee consisting of one DOE and one Chevron member, each having one vote, to supervise exploration, development, and production operations. The prime contractor on-site, known as the Unit Operator, is responsible for carrying out all actions necessary to complete approved projects.

After a project is approved the Unit Operator's Construction Department surveys the proposed project site and prepares project layouts, routes for access roads and pipelines, and repositioning of existing facilities within the limits defined by project engineers.

The Unit Operator's Environmental Affairs Department is responsible to the Director for initiating all actions necessary for compliance with environmental laws and regulations associated with construction, maintenance, and operational activities on NPR-1. It is assisted in this effort by the Endangered Species Contractor which is charged with conducting the necessary studies to provide DOE with sufficient information to comply with the Endangered Species Act.

2. METHODS

2.1 TRANSECTS

Ground transects were walked by trained observers who examined the proposed project sites for evidence of endangered species. In 1980 the first preconstruction surveys of well pads were conducted by locating the proposed center of the well pad and then walking a series of paths of ever increasing radius out to 150-200 yards (Medica, 1980).

In 1981 survey techniques were altered to accommodate the different requirements of discrete project areas and corridors. Discrete areas included rectangular surface disturbances, usually of large size, constructed for placement of well drilling equipment, tank settings, equipment storage, and production and support facilities. Parallel transects spaced about 20 yards apart were walked over the proposed site and a 100-yard buffer around the perimeter. Corridors included linear projects such as roads, pipelines, fences, and powerlines. One observer surveyed a transect along the proposed centerline and a buffer width of 25 yards. Corridors having wider right-of-ways were surveyed by two or more observers walking transects of equal widths.

As the observers gained more experience and better project layout diagrams were provided, surveys were altered further. Emphasis was placed on locating survey stakes in the field to more accurately define potential disturbances, routing of new pipelines and roads, and the rerouting of existing pipelines. Transect orientation and spacing was made more flexible to adapt to site-specific project layouts, and this led to a more thorough, efficient preconstruction survey.

Regardless of the orientation or spacing of transect surveys the following types of information were recorded: 1) date; 2) site identification or segment of corridor surveyed; 3) anticipated construction start-up and deadline dates; 4) presence of kit fox sign (i.e., dens, scats); 5) presence of blunt-nosed leopard lizards or their habitat; 6) presence of giant kangaroo rats burrow systems; 7) relation of fox dens, blunt-nosed leopard lizard habitat, kangaroo rat burrows to the proposed construction zone; 8) degree to which dens or blunt-nosed leopard lizard habitat were threatened by proposed construction activity; and 9) recommendations to prevent direct impacts.

Dens found were positively identified as those of kit fox only when the investigator was satisfied that the size and shape of the den and

associated sign were consistent with those of a kit fox den. If there was any doubt they were described as being of unknown origin.

Lathe stakes with various colors of survey tape are used to signify different components of construction project layouts in the field. Stakes with a combination of green, yellow, and blue tapes were assigned by the Unit Operator's Construction Department to provide a unique way for personnel to identify kit fox dens. Placing several of these stakes around a den made them more conspicuous and helped prevent their inadvertent destruction.

2.2 IMPACT ASSESSMENT CRITERIA

Criteria used to evaluate potential direct impacts of NPR-1 activities on endangered species and their habitats included: 1) presence of San Joaquin kit fox dens on or near project sites, 2) relation of project site to blunt-nosed leopard lizard preferred habitat, 3) presence of giant kangaroo rat burrow systems on or near the project site, 4) presence of dens of unknown origin on or near the project site, 5) extent of new habitat disturbances resulting from proposed activity, and 6) location of proposed project site in relation to existing development.

2.2.1 San Joaquin Kit Fox

Actions taken to avoid impacts of construction activity on kit fox were focused on conservation of dens. Conservation of multiple-entrance dens, especially pupping dens (dens used to shelter puppies), was considered to be essential. Efforts were made to conserve single-entrance kit fox dens when possible.

Dens were conserved whether there was evidence of recent use or they appeared to have been temporarily abandoned. However, evidence of recent use of den sites was considered when determining the width of buffers between dens and construction activities. Generally, construction activities were kept farther away from active dens than from inactive dens.

Atypical dens, such as pipes and drainage culverts, were conserved when construction activities would clearly not jeopardize them. If construction activities threatened an atypical den, any kit fox in the structure was removed and steps were taken to prevent its reuse.

2.2.2 Blunt-Nosed Leopard Lizard

So little is known about the ecological life history requirements of the blunt-nosed leopard lizard that only one useful impact assessment criterion was developed: broad sandy washes, a preferred habitat for the lizard (Brode et al., 1980), were protected from unnecessary, extensive disturbances.

2.2.3 Giant Kangaroo Rat

Giant kangaroo rats construct characteristic burrow systems consisting of an average of seven entrances measuring 2.5-3.5 inches in diameter (O'Farrell et al., 1985b). Vegetation is clipped over large areas surrounding the entrances, and there are numerous trails, haystacks, and vertical caches in the soil (Grinnell, 1932). On the valley floor these burrow systems cover large contiguous areas, but in steep terrain there are isolated occurrences of one to five burrow systems (O'Farrell et al., 1985b)

If giant kangaroo rat burrow systems were found in the vicinity of a project site, every effort was made to orient the disturbance to avoid destroying the burrows.

2.2.4 Type and Areal Extent of Disturbances

The areal extent of previously undisturbed habitat that would be lost to construction was considered and heavily weighted in favor of habitat preservation. Site layout, position of access roads, and routes of associated powerlines and pipelines were evaluated to determine whether the proposed disturbance was the minimum size necessary to accomplish its task. The size of a proposed project was also weighted based on the proportion of undisturbed habitat that would remain after the disturbance. For example, a 5-acre project that would occupy an area of previously undisturbed habitat was usually judged to have less impact than a comparable project placed in an area where 50-60% of the habitat had been lost to previous construction activities.

The type and intensity of disturbances was also evaluated. Earth moving, grading, compaction, waste disposal, and repeated off-road travel over the same route were considered to be intense disturbances that resulted in the long-term loss of habitat. They were evaluated most carefully to insure that they were of minimal size and were placed the maximum distance from endangered species and their habitats. Low intensity activities, such as casual off-road travel for limited reasons such as surveying an area, placement of power poles and stringing electrical wires

between them, and building fences usually resulted in benign damage to surface soils and vegetation that was repaired rapidly. These disturbances were not considered to be as critical to conservation activities and received a wider tolerance.

2.2.5 Dens of Other Species or of Unknown Origin

Other species on NPR-1 including coyotes, badgers, California ground squirrels, and burrowing owls make and use dens, and some of their dens are modified by kit foxes for their use. These dens were conserved when possible to avoid the accidental burial of kit foxes that may have been using them during construction activities. The dens were also avoided to help maintain the quality of habitat for wildlife in general on NPR-1.

A dichotomous decision tree was developed to aid in the assessment of potential impacts of projects on endangered species, their habitats, and on other wildlife (Table 1). The tree also helped guide reporting requirements and recommendations.

2.3 REPORTING AND DATA STORAGE

The Endangered Species Contractor was notified of projects which required a preconstruction survey by the Unit Operator's Environmental Affairs Department. After completion of the survey, the Endangered Species Contractor verbally reported the results and recommendations to the Environmental Affairs Department. Verbal reports were followed by written summaries of the survey results. The Environmental Affairs Department then notified whoever was involved with construction of that project of the survey results and any needed project modifications. In many cases, the Endangered Species Contractor also informally notified construction personnel of survey results and recommendations.

The reports which were submitted to the Unit Operator's Environmental Affairs Department were brief summaries of survey results and recommendations. In most cases where recommendations were made to modify projects, personnel from the Unit Operator's Environmental Affairs and Construction departments and from the Endangered Species Contractor visited the site to verify that the modifications were acceptable to all parties. Data gathered during surveys and all maps used were filed with the Endangered Species Contractor.

Table 1. Dichotomous decision tree used to assess potential impacts during preconstruction surveys, and to guide recommendations for mitigations.

1a. Survey conducted, no conflicts found	Report results to the Unit Operator.
1b. Survey conducted, conflicts found	2
2a. Conflict involves endangered species or their habitat	3
2b. Conflict involves giant kangaroo rat burrows or wildlife habitat considerations only	12
3a. Conflict involves San Joaquin kit fox	4
3b. Conflict involves blunt-nosed leopard lizard	10
4a. Conflict involves kit fox den	5
4b. Conflict involves den of other species, unidentified den, or an atypical den	13
5a. Den is directly threatened by construction	6
5b. Den is not directly threatened by construction	15
6a. Construction involves short-term impact	Identify specific areas to be avoided. Inform Unit Operator's Environmental Affairs and Construction departments.
6b. Construction involves long-term impact	7
7a. Consultation with Construction Department indicates alternative project sites available or project can be modified to avoid impacting den	8

Table 1. Dichotomous decision tree used to assess potential impacts during preconstruction surveys, and to guide recommendations for mitigations (continued).

7b.	Consultation with Construction Department indicates alternative project sites not available or project cannot be modified to avoid impacting den	Report results to Unit Operator. Recommend project suspension.
8a.	Kit fox den appears active	9
8b.	Kit fox den appears inactive	Distance of construction activities from den should be at least 10 yards. Greater distances may be required for dens located downhill from construction.
9a.	Active den is a pupping den	Buffer of at least 50 yards between construction activities and den. Recommend a delay of construction so activities will not take place during pupping season.
9b.	Active den is not a pupping den	Buffer of at least 25 yards between construction activities and den.
10a.	Conflict involves site known to support blunt-nosed leopard lizard	11
10b.	Conflict involves site which may support blunt-nosed leopard lizard	12
11a.	Consultation with Construction Department indicates alternative project sites available or project can be modified to avoid impacts	Report recommendations to Unit Operator.
11b.	Consultation with Construction Department indicates alternative project sites not available and project cannot be modified to avoid impacts	Report results to Unit Operator. Recommend suspension of project.

Table 1. Dichotomous decision tree used to assess potential impacts during preconstruction surveys, and to guide recommendations for mitigations (continued).

12a. Consultation with Construction Department indicates alternatives available that will minimize habitat impacts	Report recommendations to Unit Operator.
12b. Consultation with Construction Department indicates alternatives not available	Report results to Unit Operator.
13a. Den is directly threatened by construction	14
13b. Den is not directly threatened by construction	15
14a. Consultation with Construction Department indicates alternative project sites available or project can be modified to avoid the den	15
14b. Consultation with Construction Department indicates alternative project sites not available and project cannot be modified	Excavate den to prevent accidental burial of kit fox.
15a. Den is situated where accidental damage to den cannot occur	Report recommendations to Unit Operator.
15b. Den is situated where accidental damage may occur	Clearly stake and flag den to avoid accidental damage. Report location of den to be avoided and recommendations to Unit Operator.

3. RESULTS

Between November 1980 and December 1984, endangered species preconstruction surveys were completed for 296 of a total of 387 major construction projects covering approximately 3590 acres (see Appendix). Two-hundred-sixty-five projects received complete endangered species preconstruction surveys, 14 projects were only partially surveyed because construction was already underway, and the written results of surveys for 17 well pads were misplaced and are unknown. Construction was complete for 91 projects prior to an endangered species survey, projects that involved a total land area of approximately 190 acres.

Discrete site surveys were conducted for 273 projects having a combined area of 567 acres. These projects included: well pads, Shallow Oil Zone vapor recovery tank settings, 32S fresh water tank, 18G free water knockout/flow splitter, 35R LPG storage facility, 27R truck washout facility, 1-7R vent stack relocation, 18G storage area, and two pumping stations for the waterflood system (Table 2).

Twenty-three projects with a combined area of 3023 acres required corridor-type preconstruction surveys. These included: the waterflood system, cathodic protection system, electrification of Shallow Oil Zone wells, seismic exploration surveys, south flank of the security fenceline, security fenceline firebreak, Shallow Oil Zone gas gathering line, natural gas liquids pipeline, a low pressure gas gathering line, and powerlines to an office trailer in Section 11G (Table 2).

Surveys of proposed well pad sites accounted for 264 of the total number of preconstruction surveys and covered approximately 528 acres (Figure 2). Construction of well pads and roads provides access to and a level surface at specific sites proposed for drilling an oil, gas, or water well. Well pads must be large enough to accommodate all equipment and supplies necessary for drilling. They are usually an average of two acres in size. A total of 141 kit fox dens, evidence of two giant kangaroo rat burrow systems, and three washes representing blunt-nosed leopard lizard habitat were observed during the surveys.

The Shallow Oil Zone tank setting vapor recovery project was installed to increase gas vapor recovery and thus improve air quality and reduce the probability of fire from ignited vapors. Preconstruction surveys were conducted at 13 sites in 12 sections (Figure 3). Construction was complete at two sites. Construction of tank pads required disturbances to native soils and vegetation which covered 9.3 acres. One kit fox den was found during surveys for this project.

Table 2. Results of preconstruction surveys conducted on NPR-1, Kern County, California, from 1980 to December 1984.

Project	Kit Fox Dens		Blunt-Nosed Leopard Lizard Habitats	Giant Kangaroo Rat Burrows	Results/Action
	Total	Number Threatened			
WELL PADS	141	75	3	2	Unit Operator environmental and construction departments notified of the location of 32 kit fox dens and four other dens. All dens clearly staked and flagged. 18 project changes made to avoid 27 kit fox dens and two other dens. 13 kit fox dens and 12 other dens excavated. Two kit fox pipe dens removed. Three kit fox dens accidentally buried during construction. Two project alterations avoided impacts to two wash habitats. Built an access road crossing a large wash, then revegetated.
POWERLINE TO TRAILER OFFICES AT THE 11G MAIN GATE	4	1	0	0	One kit fox den clearly staked and flagged.
SECTION 33R 8-INCH LOW PRESSURE NATURAL GAS LINE	0	0	0	0	NONE

Table 2. Results of preconstruction surveys conducted on NPR-1, Kern County, California, from 1980 to December 1984 (continued).

Project	Kit Fox Dens		Blunt-Nosed Leopard Lizard Habitats	Giant Kangaroo Rat Burrows	Results/Action
	Total	Number Threatened			
SEISMIC SURVEYS:					
1982 Seismic Surveys NPR-1	3	0	1	0	Dens clearly marked.
1982 Seismic Survey NW "R"	1	1	0	0	Rerouted seismic line to avoid den.
1984 Seismic Survey Section 6M	0	0	0	0	Rerouted seismic line four times to avoid four unidentified dens.
1984 Seismic Survey Sections 14 and 24Z	0	0	0	0	11 badger dens marked with pink flagging so vehicles would avoid them.
1984 Seismic Survey NW "R"	1	1	Several	0	Kit fox den clearly staked and flagged so vehicles would avoid it.
WATERFLOOD SYSTEM:					
18G Booster Station	0	0	0	0	NONE
33S Pumping Plant	2	0	0	0	Construction underway prior to survey.
17R Booster Station	0	0	0	0	NONE
Pilot Waterflood Project	2	0	0	0	NONE
Source Well Gathering Line	2	1	0	0	Single entrance kit fox den excavated.
Electrification of Water Source Wells	1	1	0	3	Results not noted. Possible *Dipodomys ingens* burrow systems at three locations.

Table 2. Results of preconstruction surveys conducted on NPR-1, Kern County, California, from 1980 to December 1984 (continued).

Project	Kit Fox Dens		Blunt-Nosed Leopard Lizard Habitats	Giant Kangaroo Rat Burrows	Results/Action
	Total	Number Threatened			
WATERFLOOD SYSTEM (continued)					
East Main Body B Distribution Pipeline	2	0	0	0	Pipeline rerouted twice to avoid small mammal trapping area in 33S and wildlife oasis in 3G.
West Main Body B Distribution Pipeline	6	3	0	0	Threatened kit fox dens staked and flagged.
East and West Main Body B Lateral Lines	5	4	0	0	Construction underway at eight locations. Rerouted pipeline to avoid one multiple entrance kit fox den. Excavated one multiple entrance erosion gully den. Two kit fox dens staked and flagged.
Northwest "R" Distribution Pipeline	7	4	0	0	Rerouted pipeline twice to avoid two kit fox dens. Excavated one single entrance kit fox den. Staked and flagged four kit fox dens.
Northwest "R" Lateral Lines	0	0	0	0	NONE

Table 2. Results of preconstruction surveys conducted on NPR-1, Kern County, California, from 1980 to December 1984 (continued).

Project	Kit Fox Dens		Blunt-Nosed Leopard Lizard Habitats	Giant Kangaroo Rat Burrows	Results/Action
	Total	Number Threatened			
WATERFLOOD SYSTEM (continued)					
Supply Pipeline 33S to 17R	2	2	0	1	Two multiple entrance kit fox dens excavated.
Northwest "R" Powerline	2	1	0	0	Staked and flagged one kit fox den.
LNG PIPELINE (ARCO)	4	3	0	2	Project subsequently suspended.
SOZ VAPOR RECOVERY SYSTEM TANK SETTINGS	1	0	0	0	Staked and flagged one single entrance kit fox den. Construction underway at two sites.
18G STORAGE AREA	0	0	0	0	NONE
CATHODIC PROTECTION SYSTEM PHASE I -- PHASE VI	42	8	0	0	Staked and flagged 37 kit fox dens. Rerouted one powerline to avoid three kit fox dens. Recommended that drilling debris not be discarded near one multiple entrance den.

Table 2. Results of preconstruction surveys conducted on NPR-1, Kern County, California, from 1980 to December 1984 (continued).

Project	Kit Fox Dens		Blunt-Nosed Leopard Lizard Habitats	Giant Kangaroo Rat Burrows	Results/Action
	Total	Number Threatened			
CATHODIC PROTECTION SYSTEM PHASE I -- PHASE VI (continued)					Recommended using existing roads rather than constructing a road for one rectifier. Construction of Phase I and II underway.
ELECTRIFICATION OF SOZ WELLS	12	5	0	0	Clearly staked and flagged four kit fox dens. One den excavated and was determined to be incomplete digs. (ACTION TAKEN February 1983.)
FIRE BREAK ALONG SOUTH FLANK SECURITY FENCELINE	9	5	30	0	Construction of firebreak underway prior to survey. Location of new firebreak moved to existing firebreak along the NPR-1 boundary.

Table 2. Results of preconstruction surveys conducted on NPR-1, Kern County, California, from 1980 to December 1984 (continued).

Project	Kit Fox Dens		Blunt-Nosed Leopard Lizard Habitats	Giant Kangaroo Rat Burrows	Results/Action
	Total	Number Threatened			
SOZ GAS GATHERING PIPELINE 18G TO 32S	4	1	0	0	Informed Unit Operator Construction and Environmental personnel. Kit fox den adequately protected from impacts due to its location beneath existing pipes.
35R LPG INCREASED STORAGE FACILITY	4	4	0	0	Construction close to completion during survey. One multiple entrance kit fox den destroyed. Location of fill site moved to avoid four kit fox dens. Unit Operator Environmental Coordinator informed.
35R SUMP MODIFICATION AND OIL/WATER SEPARATION FACILITY	0	0	0	0	Construction complete prior to survey. Unit Operator Environmental Department informed.
1-7R STEVENS TANK SETTING VENT STACK RELOCATION	0	0	0	0	NONE

Table 2. Results of preconstruction surveys conducted on NPR-1, Kern County, California, from 1980 to December 1984 (continued).

Project	Kit Fox Dens		Blunt-Nosed Leopard Lizard Habitats	Giant Kangaroo Rat Burrows	Results/Action
	Total	Number Threatened			
32S FRESH WATER TANK	0	0	0	0	NONE
18G FREE WATER KNOCKOUT-FLOW SPLITTER TANK PAD	3	2	0	0	Rerouted two water flow-lines to avoid two multiple entrance kit fox dens.
27R TRUCK WASHOUT FACILITY	0	0	0	0	Surveyed again in February 1984 prior to construction.

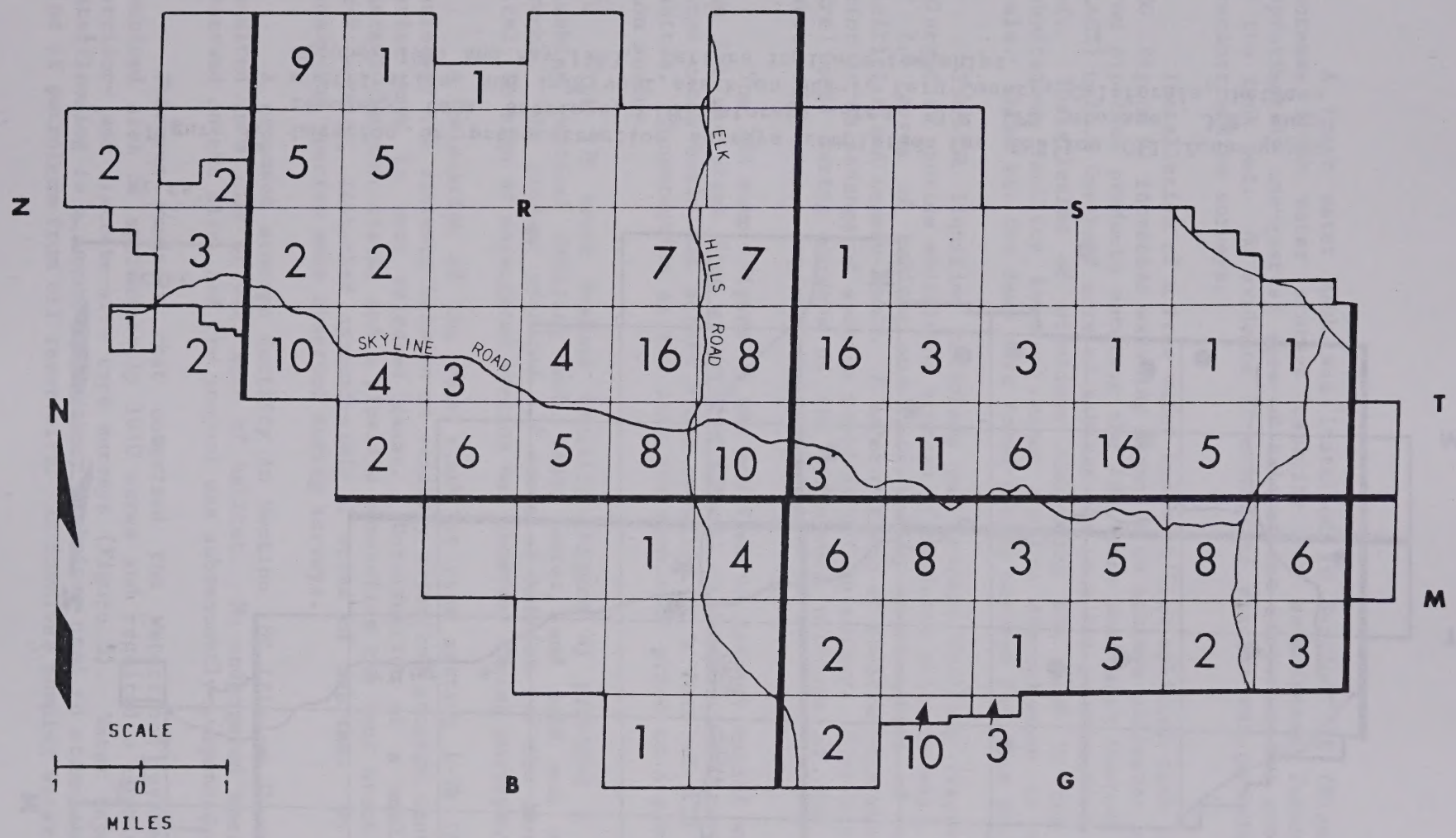

Figure 2. Number of preconstruction surveys completed for well pads in sections of NPR-1, Kern County, California, between November 1980 and December 1984. Letters indicate towships.

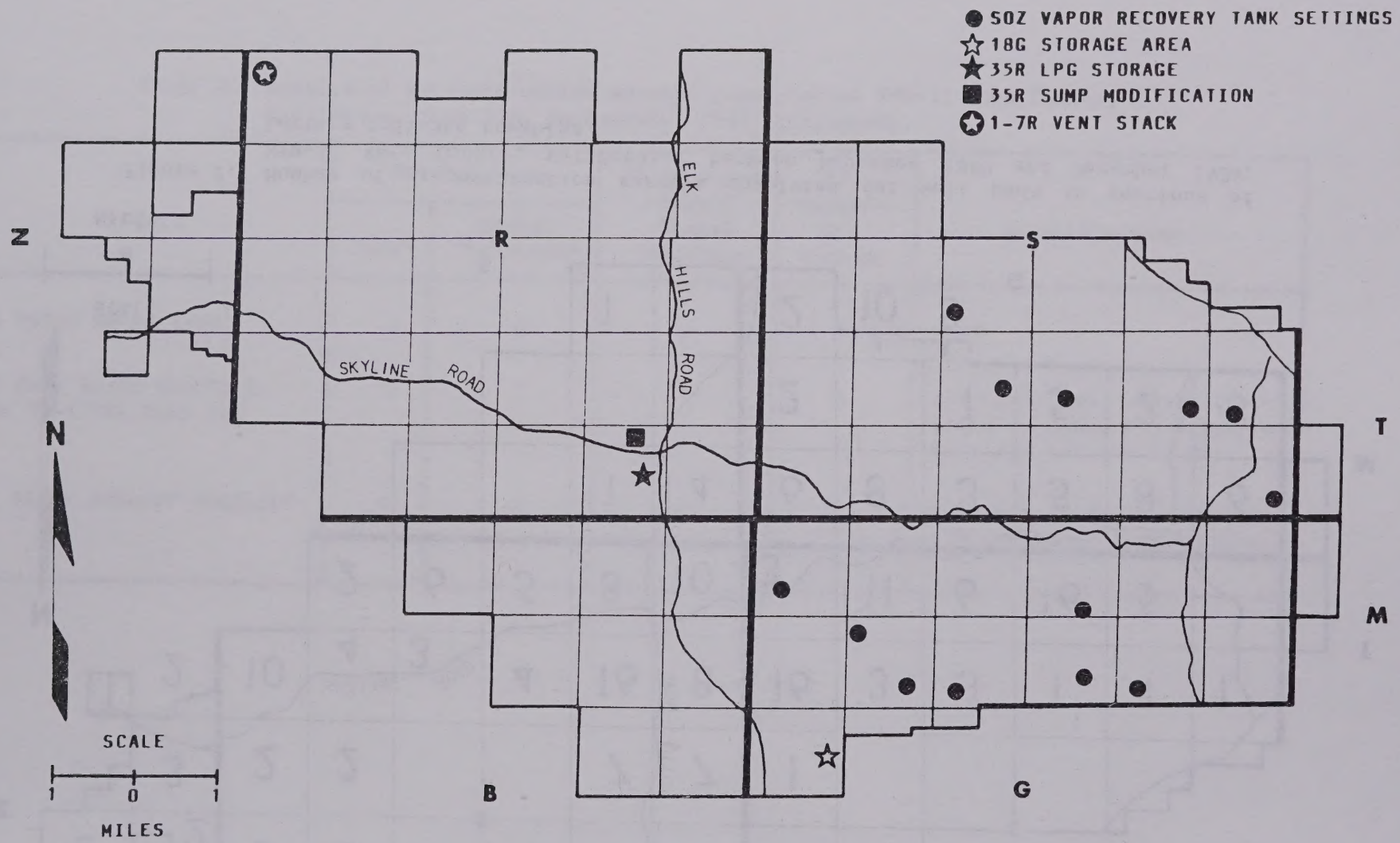

Figure 3. Location of preconstruction surveys completed for Shallow Oil Zone vapor recovery tank settings, 18G storage area, 35R LPG storage, 35R sump modification, and 1-7R vent stack on NPR-1, Kern County, California, between October 1981 and May 1983. Letters indicate townships.

A fresh water tank was installed in Section 32S (Figure 4) to increase fresh water storage capacity for anticipated future needs. Approximately one-quarter acre of habitat was disturbed for construction of the tank pad. No evidence of endangered species was gathered during preconstruction surveys.

Installation of a free water knockout/flow splitter tank in Section 18G (Figure 4) increased existing capacity to achieve oil/water separation from pipeline products entering the 18G Lease Automatic Custody Transfer (LACT) unit. One-half acre of habitat was lost for construction of a tank pad. Installation of pipelines connecting the tank to the existing dehydration facility involved minor surface disturbances on a smaller scale. Three kit fox dens were found during surveys for this project.

The 35R liquified petroleum gas storage facility (Figure 3) was enlarged to provide additional storage of products prior to sale. A total of 7.4 acres of habitat was lost during construction of additional facilities and access roads. A major portion of construction was complete prior to an endangered species preconstruction survey. Four kit fox dens were found during surveys of the unfinished portions of the site and surrounding area.

The 35R sump (Figure 3) was modified to prevent runoff water from the 35R gas plant from entering a natural drainage. Construction of a large catch basin and access roads resulted in a loss of 4.9 acres of habitat. Construction at the site was completed prior to a preconstruction survey.

The 27R truck washout facility (Figure 4) provided a site for flushing residual drilling mud, waste water, and acid out of vacuum trucks. The project required 5.9 acres of habitat for the construction site. No sign of endangered species was observed during surveys.

A relocation of the vent stack at tank setting 1-7R (Figure 3) increased the distance between an existing petroleum storage tank and the device used to vent released gases. Construction of a small pad to install the vent stack, and a pipeline connecting the vent stack with the tank setting, disturbed approximately 2 acres of habitat. No signs of endangered species were observed during surveys.

A proposed storage facility in Section 18G (Figure 3) would have resulted in a loss of 0.75 acre of habitat. No endangered species were observed on the site, and the project was subsequently suspended.

Thirteen projects that comprised the waterflood system had a combined area of approximately 1010 acres and required a combination of corridor- and discrete-site type surveys (Figure 5). Water injection or waterflooding is a secondary recovery technique used to stimulate production of petroleum from oil reservoirs. It involves pumping water into the

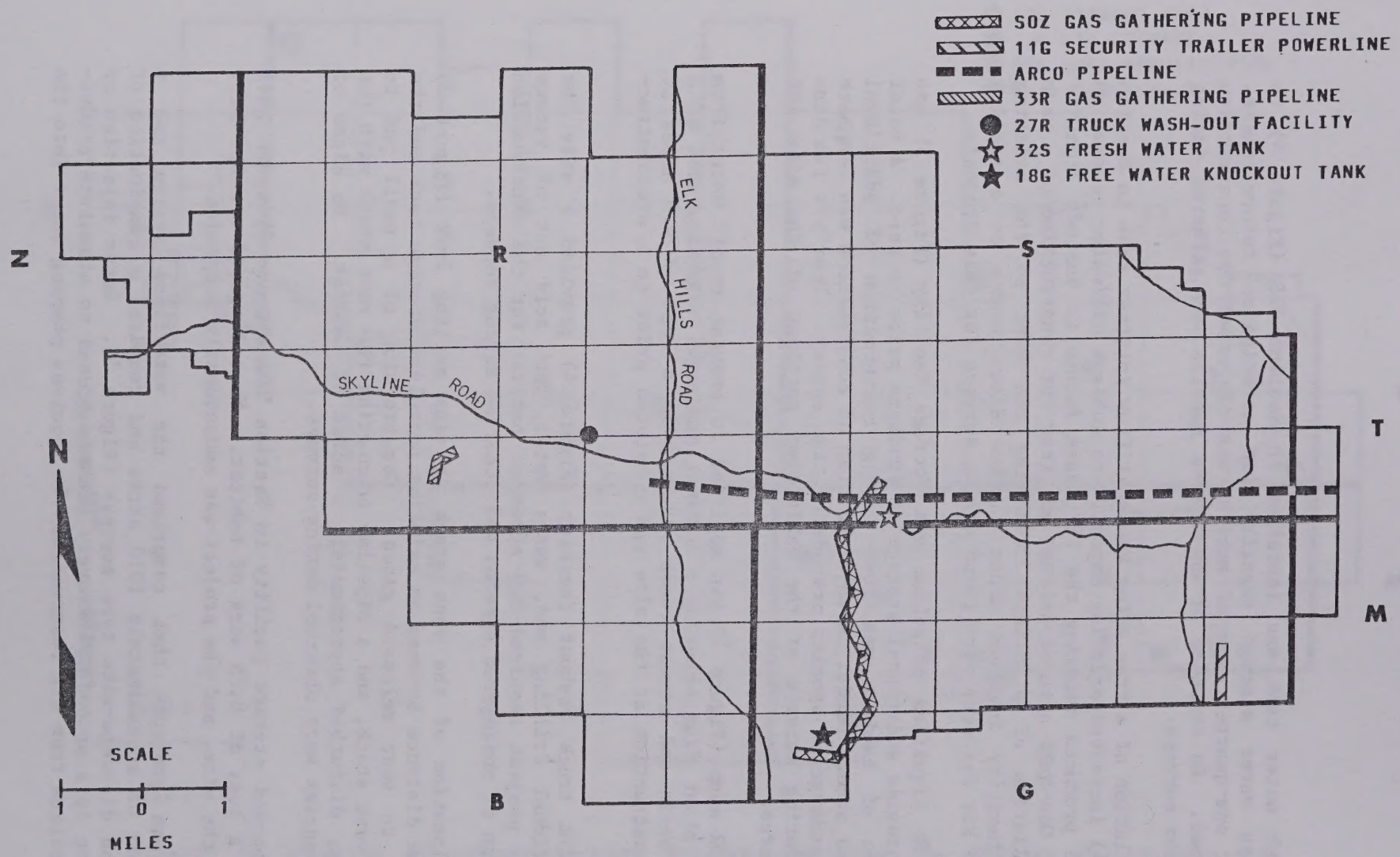

Figure 4. Location of preconstruction surveys completed for the Shallow Oil Zone gas gathering line, 11G security trailer power line, LNG pipeline, 33R gas gathering pipeline, 27R truck washout facility, 32S fresh water tank, and the 18G free water knockout tanks on NPR-1, Kern County, California, between August 1981 and June 1984. Letters indicate townships.

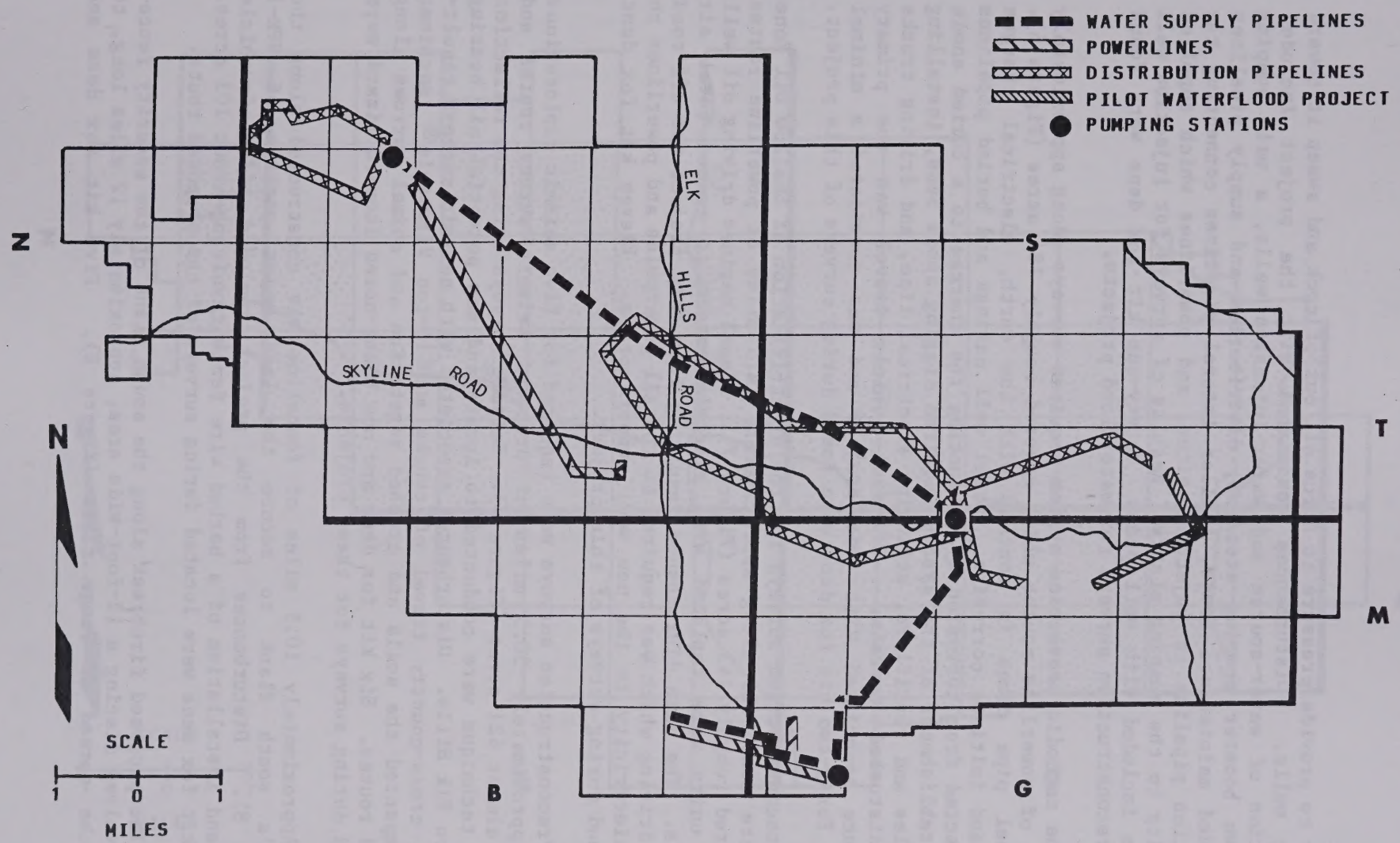

Figure 5. Routes of preconstruction surveys for major portions of the Waterflood System on NPR-1, Kern County, California, conducted between April 1981 and March 1982. Letters indicate towships.

reservoir to provide pressure to force oil out of rock and sweep it toward producing wells. Disturbances associated with the project included construction of water-source and water-injection wells, a main pumping plant, two booster pumping stations, distribution and supply pipelines with graded maintenance roads, smaller lateral pipelines connecting the distribution pipeline to injection sites, and powerlines which supplied electricity to the pumping plants. Results of surveys for injection well sites are included with well pads. Thirty-one kit fox dens were found during preconstruction surveys for waterflood projects.

The cathodic protection system required surveys along approximately 79 miles of powerline routes which covered roughly 784 acres (Figure 6). When steel pipe comes in contact with the earth, electrical charges develop and initiate corrosion. Steel well casings and buried pipelines are protected from corrosion by conducting the charges to a buried anode bed. Establishment of the system required digging anode beds, installing power poles and rectifiers, stringing electrical line, and driving trucks over undisturbed terrain. Off-road vehicle travel was the primary disturbance associated with this project and was considered a minimal impact. Forty-two kit fox dens were found during surveys of this project.

Preconstruction surveys for the electrification of Shallow Oil Zone wells were conducted along approximately 14.5 miles of powerline routes and covered roughly 143 acres (Figure 7). Diesel engines driving oil well pumping units were replaced with electric motors to reduce total air emissions. The main disturbance resulting from this project was off-road vehicle driving which was required to install powerpoles and powerlines to supply electricity to the new well pumper motors. Eleven kit fox dens were found during surveys of this project.

Preconstruction surveys were required for five seismic explorations along approximately 50.5 miles of proposed seismic survey routes and covered almost 621 acres (Figure 8). Seismic surveys using the reflection seismic technique were conducted to locate and map potential oil bearing strata on Elk Hills. Disturbances associated with seismic surveys resulted from cross-country travel of trucks and 19-ton Vibroseis® machines that compacted the soils and crushed vegetation and animal burrows along proposed routes. Six kit fox dens and one blunt-nosed leopard lizard were observed during surveys for these projects.

Approximately 10.5 miles of fenceline was constructed along the Reserve's south flank to secure the last major portion of NPR-1 (Figure 8). Disturbances from the project included off-road-vehicle travel and installation of a barbed wire fence involving about 103 acres. Twelve kit fox dens were located during surveys of the proposed route.

The proposed firebreak along the south flank of the security fenceline involved discing a 12-foot-wide area, approximately 12 miles long, to check the spread of range fires (Figure 8). Five kit fox dens and

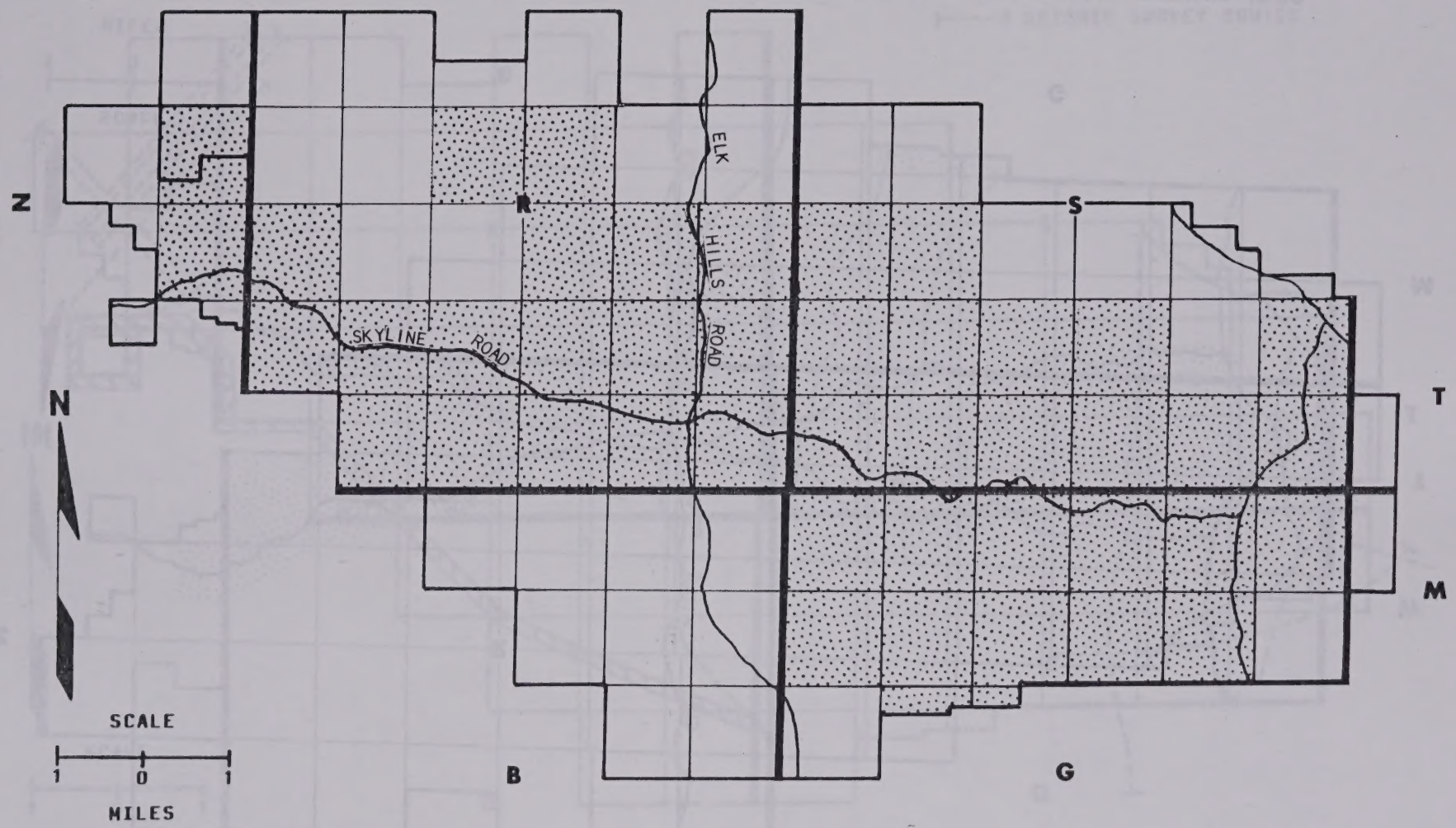

Figure 6. Sections of NPR-1, Kern County, California, where preconstruction surveys were conducted for Phases I-VI of the Cathodic Protection System between August 1981 and November 1981 (stippled area). Letters indicate townships.

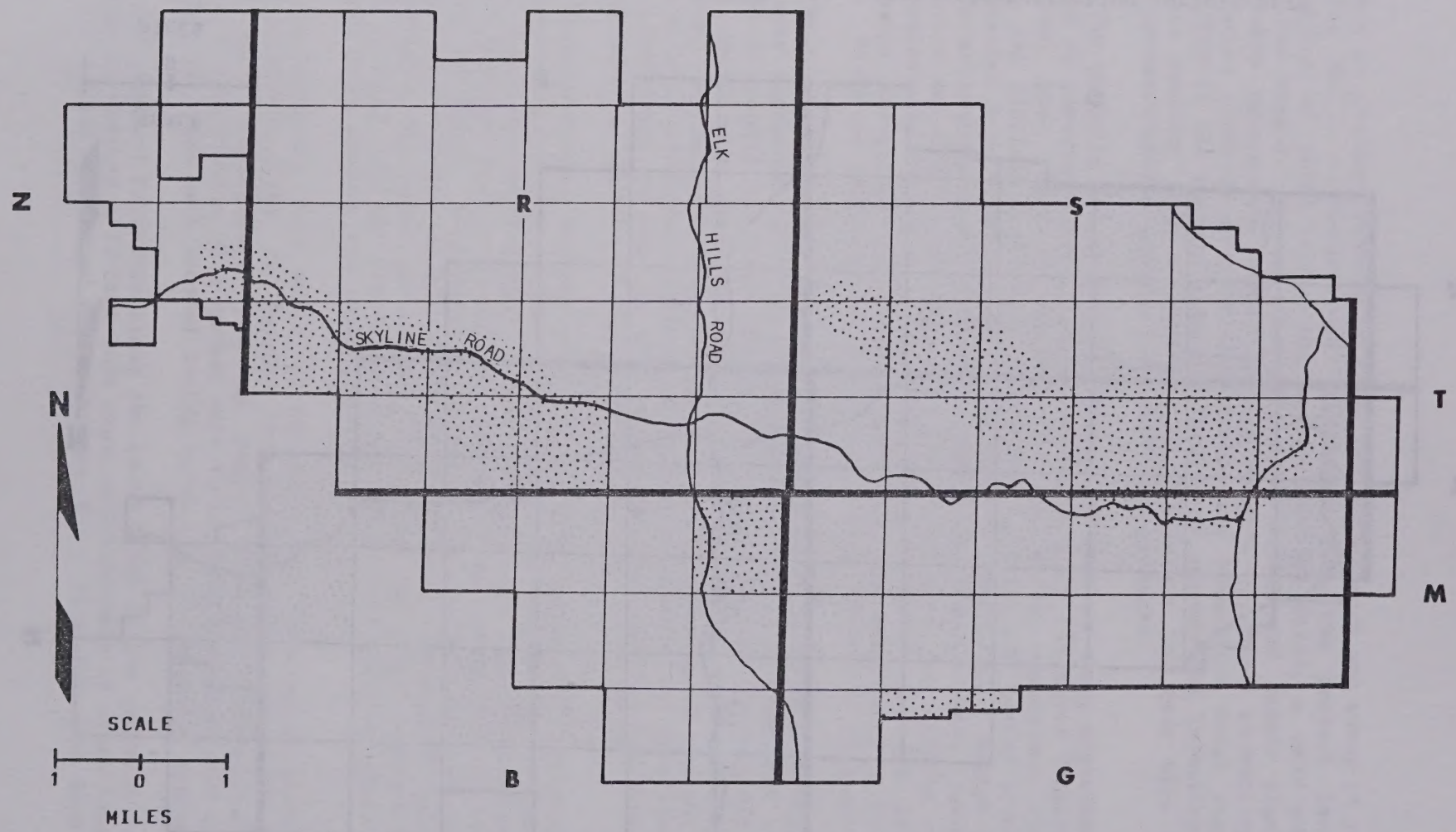

Figure 7. Areas on NPR-1, Kern County, California, where preconstruction surveys were conducted for the electrification of Shallow Oil Zone wells from November 1981 to January 1982 (stippled area). Letters indicate townships.

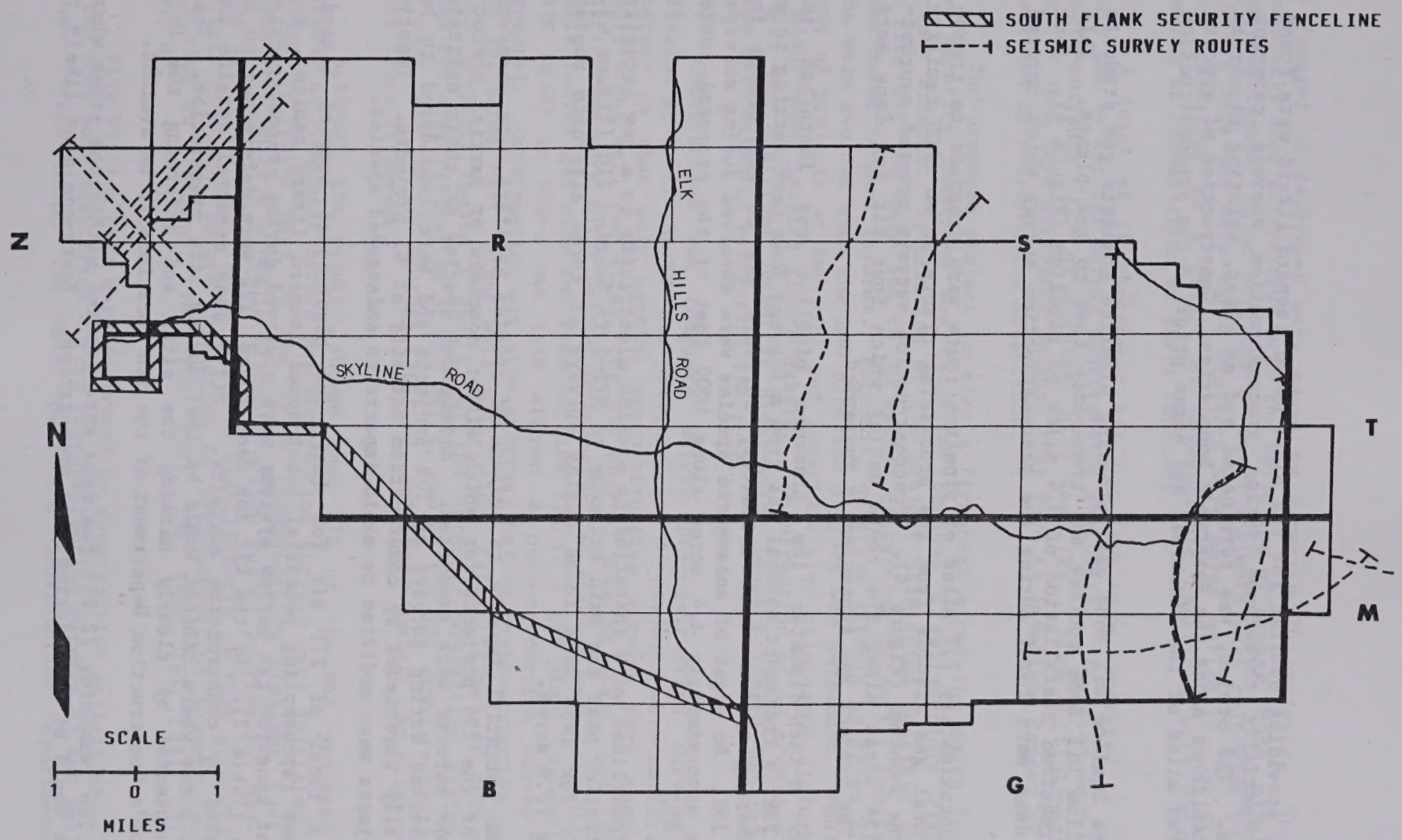

Figure 8. Routes of preconstruction surveys conducted for seismic surveys and the south flank of the security fenceline on NPR-1, Kern County, California, between April 1982 and May 1984. Letters indicate townships.

30 washes providing habitat for the blunt-nosed leopard lizard were found to be potentially threatened during preconstruction surveys covering 180 acres. The project was terminated and an older, existing firebreak was reestablished along the Reserve's boundaries. Construction of approximately two miles of the firebreak had begun prior to the preconstruction survey.

The Shallow Oil Zone gas gathering pipeline collects gas products from Shallow Oil Zone sources and transports them to gas plants. This project required installation of 3.4 miles of pipeline (Figure 4). Four kit fox dens were found during the preconstruction survey which covered 34 acres.

Approximately 7.7 miles of pipeline route were proposed to transport natural gas liquids from gas processing plants to an ARCO facility off of the Reserve (Figure 4). Preconstruction surveys covered approximately 154 acres along the route during which four kit fox dens were found. The project was subsequently suspended.

An 8-inch-diameter low pressure pipeline was installed in Section 33R to transport natural gas from a Stevens Zone tank setting to a gas gathering system which ultimately delivers gas to gas plants in Section 35R. No signs of endangered species were observed during surveys covering approximately 1.4 acres along 1000 feet of the proposed route (Figure 4).

Powerlines were installed to provide electricity to a new security office trailer near the main entrance to NPR-1 in Section 11G (Figure 4). Four kit fox dens were found during surveys of three alternate routes covering 10.9 acres.

No potential impacts to endangered species habitats were observed at 187 of the 296 projects for which either complete or partial preconstruction surveys were conducted. Endangered species or their habitats were observed during surveys of 109 projects and were considered to be potentially threatened by construction activity at 63 projects. Twenty-six projects were modified to avoid impacts to endangered species.

A total of 271 kit fox dens, one blunt-nosed leopard lizard, 33 washes representing potential blunt-nosed leopard lizard habitat, and 12 giant kangaroo rat burrow systems were observed during preconstruction surveys (Table 2). Of the kit fox dens found, 122 were determined to be threatened by construction activity. Fifty dens occurred outside the project areas where habitat would be lost during site preparation. They were protected by clearly marking the sites and informing the Unit Operator's Construction Department of the den locations to be avoided.

The remaining 72 kit fox dens were located within the areas where habitat would be lost during site preparation. Forty-one dens likely to

be damaged or destroyed were saved by altering 26 projects. The most frequently used alterations were the rerouting of access roads, pipelines, and powerlines. Major portions of seven projects were relocated to avoid kit fox dens and only three projects were moved entirely. No projects were cancelled as a result of unresolvable conflicts with endangered species or conservation of their habitats.

A total of 19 threatened kit fox dens were excavated to prevent their use by kit fox during construction activities. Fourteen were either single-entrance (12) or atypical pipe dens (2). Five multiple-entrance kit fox dens were excavated because they were in immediate danger of being destroyed by construction activities.

The proposed project to disc a firebreak along the south flank of the security fenceline was cancelled because a satisfactory firebreak already existed. Termination of the project eliminated possible impacts on five kit fox dens and to 30 washes containing potential habitat for blunt-nosed leopard lizards. Potential negative effects on three kit fox dens were avoided when the LNG pipeline project was suspended. Modifications of projects at two well pad locations also eliminated disturbances of blunt-nosed leopard lizard habitat. Construction of an access road to a well pad disturbed potential blunt-nosed leopard lizard habitat, but steps were taken to revegetate the road.

Construction was complete before preconstruction surveys were initiated at 91 of the 387 new projects, and 14 projects were sufficiently underway so that only partial preconstruction surveys were completed. Eighty-eight well pad sites, the 33S central pumping plant, and 35R sump modification were built before preconstruction surveys were initiated. A 7-mile buried gas pipeline from Section 35R to a gas plant in Section 1C (T32S R23E) in NPR-2 was laid without a preconstruction survey being requested. Construction was also underway before preconstruction surveys were initiated for: eight well pads, eight lateral lines of the waterflood project, Phases I and II of the cathodic protection system, two sites for electrification of SOZ wells, two of the SOZ vapor recovery tank settings, the 35R LPG storage facility, and approximately two miles of the south flank firebreak.

Although the results showed that 27% of the MER projects were underway or completed before preconstruction surveys were initiated, this average reflected many of the early communication problems that were encountered while a workable preconstruction survey program for NPR-1 was being developed. The record improved significantly as that proportion of projects completed before initiation of preconstruction surveys declined with time as follows: 1980, 74%; 1981, 39%; 1982, 16%; 1983, 11%; and 1984, 0%.

Five kit fox dens were destroyed by construction activities. Three of the dens were identified during preconstruction surveys of two well pad sites. Even though the Unit Operator's Construction Department was

notified of the locations of the dens, poor communications and equipment operator mistakes resulted in burial of the dens. The fourth den was previously identified during radiotelemetry studies. It was buried during construction of the 35R LPG storage facility, which was almost completed before a preconstruction survey was initiated. The fifth den was also located during radiotelemetry studies, on a newly constructed well pad. This den was buried during well drilling cleanup operations.

Recommended project modifications successfully reduced the areal extent of six projects. Habitat disturbances were reduced most frequently by recommending either changes in the configuration of new roads, or that existing roads be used for access rather than having new, redundant roads built. Portions of the water flood pipeline corridor were realigned to avoid destruction of a small-mammal trapping area where data were gathered to monitor kit fox prey availability, and a wildlife watering station that was installed as part of an earlier wildlife habitat enhancement program.

A total of 44 badger dens, 24 coyote dens, 21 unidentified dens, two rabbit burrows, and two erosion-gully dens were found during preconstruction surveys. Eight of these dens were excavated prior to construction, to prevent kit foxes from being accidentally buried in them.

The complex interaction of responsibilities between DOE/NPR-C, Unit Operating Committee, Unit Operator departments, and the Endangered Species Contractor (Section 1.4), plus the need for timely reporting of the results of preconstruction surveys (Section 2.3), led to development of a communications flow chart (Figure 9). The Unit Operator's Environmental Affairs Department determined whether a project approved by the Director required a preconstruction survey of potential conflicts with endangered species and their habitats. The Environmental Affairs Department notified the Endangered Species Contractor when a preconstruction survey was required, and they provided the necessary information on where the proposed project was located and what the construction schedule was. When the Endangered Species Contractor completed a survey they reported the results and their recommendations to protect endangered species and their habitats to the Environmental Affairs Department.

Due to the large number, but unpredictable scheduling, of well pad construction projects, communication pathways were later changed to improve the efficiency and timeliness of reporting the results of well pad preconstruction surveys. The Environmental Affairs Department retained the responsibility for ensuring that preconstruction surveys were conducted for well pads, but they delegated communication tasks to the Unit Operator's Construction Department. The Construction Department was responsible for notifying the Endangered Species Contractor of any well pad construction activities, including the upgrading of existing sites, so that preconstruction surveys could be conducted before habitat disturbances occurred. The responsibility for ensuring that surveys were conducted and that necessary minor alterations were made to avoid possible negative impacts on endangered species was shared by the Construction Department and the Endangered Species Contractor.

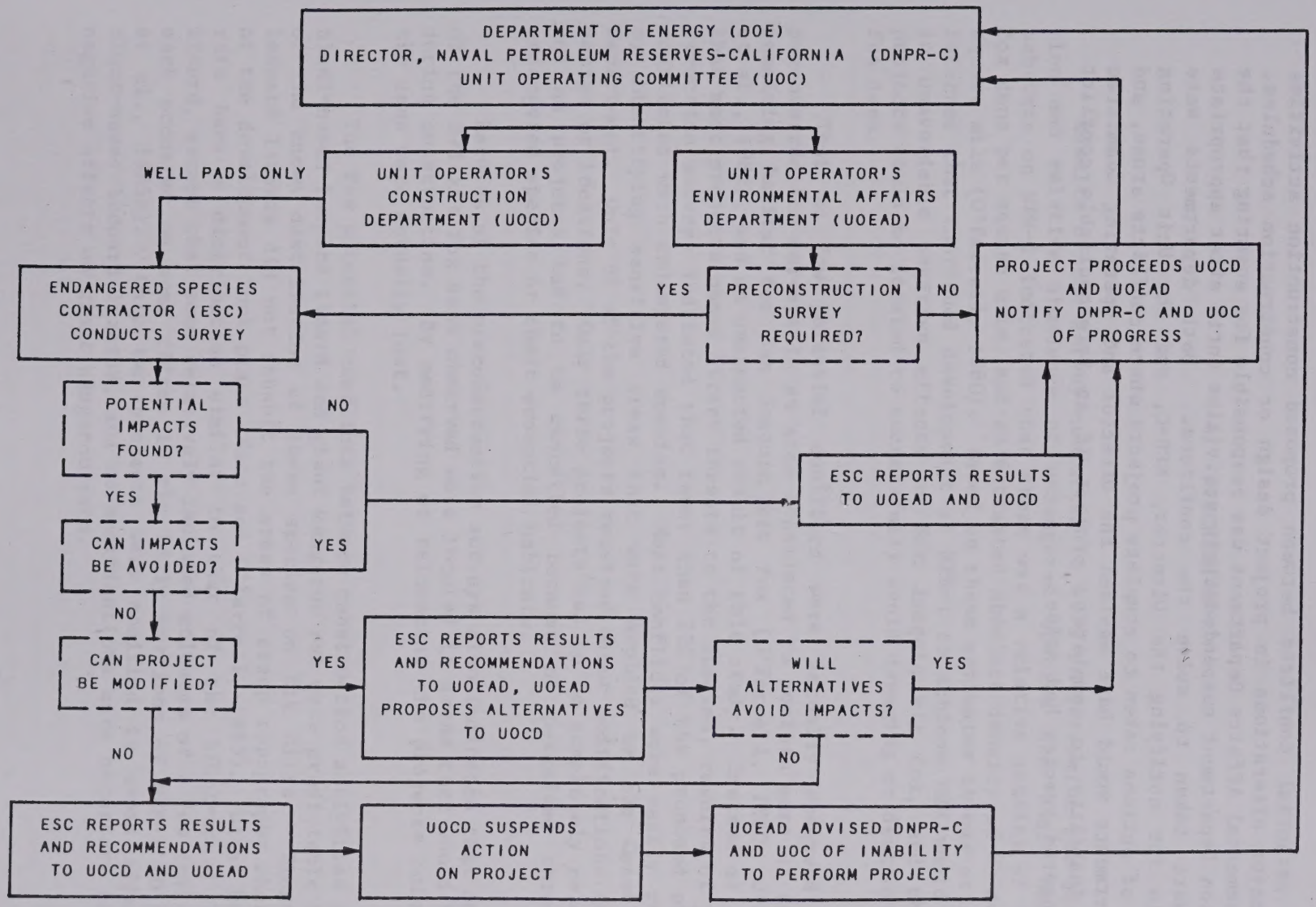

Figure 9. Flowchart showing types of decisions made and relationships among DOE, DNPR-C, Unit Operating Committee, Unit Operator's Environmental Affairs and Construction departments, and the Endangered Species Contractor for preconstruction surveys conducted on NPR-1, Kern County, California, from November 1980 to December 1984.

If potential conflicts between proposed construction activities required major alterations in project design or construction schedules, the Environmental Affairs Department was responsible for ensuring that the Construction Department suspended their activities until after appropriate actions were taken to solve the conflicts. Both departments were responsible for notifying the Director, NPR-C, and the Unit Operating Committee of actions taken to complete projects where conflicts arose, and both departments would have advised the Director and Operating Committee of their inability to complete a project if an irreconcilable conflict with endangered species had arisen.

4. DISCUSSION

Results of the survey conducted in 1979 to determine the distribution and relative abundance of endangered species and their essential habitats on NPR-1 indicated that there was a relative density of 9.2 kit fox dens per square mile, and an estimated absolute density of 84 dens per square mile (O'Farrell, 1980). Based on these estimates it was originally inferred that continued development of NPR-1 to achieve MER would result in unavoidable negative effects on San Joaquin kit fox, and that few projects could be located to successfully avoid damaging or destroying kit fox dens.

That so few potential conflicts were actually observed during preconstruction surveys in an area considered to contain some of the best remaining habitat for San Joaquin kit fox (O'Farrell, 1980; O'Farrell et al., 1985), was an unexpected result of this study. Instead of showing that most projects posed direct threats to the species, results of preconstruction surveys indicated that fewer than 22% of the proposed projects conflicted with endangered species. Most conflicts were easily resolved by identifying sensitive areas that were avoided by the Construction Department. Only 8% of the projects received minor modifications in their design or locations. Only three projects had to be completely relocated, and no projects had to be cancelled because of perceived threats to endangered species or their essential habitats.

Results of the preconstruction surveys also indicated that only 27% of the 271 kit fox dens observed were located in areas that would be lost during construction. By modifying or relocating the projects only 8% of the dens were actually lost.

The few potential conflicts between construction activities and the blunt-nosed leopard lizard and giant kangaroo rat were predictable because of the known distribution of these species on Elk Hills. Blunt-nosed leopard lizards did not inhabit the areas of steep topography where most of the development took place (Kato and O'Farrell, 1985). Giant kangaroo rats have a distribution similar to that of the blunt-nosed leopard lizard, except that some relatively isolated colonies of a few individuals each occurred on some ridges in the hilly portions of NPR-1 (O'Farrell et al., 1985b). Only two projects were modified to avoid effects on blunt-nosed leopard lizards, and no modifications were necessary to avoid negative effects on giant kangaroo rats.

The implementation of preconstruction surveys did not interfere with DOE achieving major program goals, and did not obstruct completion of construction projects in a timely way. This was most evident in results which showed how infrequently potential conflicts between endangered species and construction projects were observed. At most project sites, endangered species habitats were not threatened and construction activities were not delayed because of the preconstruction survey process. In a number of cases the Endangered Species Contractor responded to requests to perform a preconstruction survey with less than a two-day advance notice. Their immediate responses helped to minimize delays in meeting construction goals and deadlines. In the few cases where conflicts arose, their resolution usually required less than one week.

Except for the support of Endangered Species Contractor personnel who conducted the preconstruction surveys, implementation of this conversation measure did not add significant costs to construction projects. Project modifications or relocations required to avoid conflicts did not require additional expenses. In a few cases the suggested relocations or modifications resulted in savings because of the deletion of redundant roads, shortening of pipelines, and ease of construction in a more suitable location.

The successful implementation of preconstruction surveys as a technique for conserving endangered species and their essential habitats in the midst of a major petroleum development program was due to at least three major factors: 1) it was implemented before each element of the project resulted in destruction of habitat, 2) there was a concurrent research program to provide essential information to guide and modify the techniques and decision matrix, and 3) there was an effective, evolving working relationship between the wildlife biologists conducting preconstruction surveys and the Environmental Affairs and Construction departments of the Unit Operator charged with carrying out the major construction activities. The program would have achieved less success, or failed, if any of these three factors had been missing.

Although it seems obvious that preconstruction surveys should be conducted to minimize conflicts with endangered species and loss of their essential habitats, the technique has not always been used. Sometimes wildlife biologists are called in to express their concerns and to suggest project modifications to minimize potential negative impacts before construction commences. Usually they are called in after projects have been completed, to retrospectively evaluate what the effects of the project were on wildlife and their habitats. Their involvement in either case, however, is usually advisory and usually passive.

On NPR-1, when wildlife biologists recommended that preconstruction surveys be adopted as a conservation technique, they were charged with developing the necessary techniques, conducting the surveys, and evaluating the effectiveness of the program. They were involved as construction activities commenced, and they remained actively involved at all

stages of the construction project. This allowed them to make proactive recommendations to resolve conflicts as they arose at each stage in the development of the program, rather than being expected to anticipate all possible problems at the beginning of construction. It also allowed them to adjust their techniques for site-specific purposes, and it allowed the wildlife biologists to work with construction personnel to achieve both construction and conservation goals. We are unaware of any other federal construction project of comparable scope that included the successful implementation of a continuous preconstruction survey program as an effective wildlife conservation technique.

Development of preconstruction surveys was enhanced by incorporating new information about the ecology of endangered species into improved procedures for conducting surveys and by making recommendations to avoid impacts. Initially available information on the ecological requirements of the endangered San Joaquin kit fox and blunt-nosed leopard lizard was supplemented with distributional and ecological data gathered during research programs on NPR-1, NPR-2, and surrounding public lands. The research programs were conducted concurrently with development of preconstruction survey techniques.

The ground transect method that formed the basis of the preconstruction surveys was developed as part of a successful program to inventory large tracts of public lands for their potential as essential habitat for endangered species (O'Farrell, 1980; O'Farrell et al., 1980). Results of these studies indicated that the estimated effective width of transect surveys for kit fox dens was 30 yards (O'Farrell et al., 1980); therefore, preconstruction surveys were spaced at intervals of less than 30 yards to insure thorough visual coverage of proposed construction sites.

A fundamental criterion for conduct of preconstruction surveys was the identification of habitats or specific habitat elements which should be protected to minimize potential negative effects of construction activities on endangered species. Information on distributions on NPR-1, preferred habitats, and significant characteristics of ecological life histories of the kit fox (O'Farrell et al., 1985a), blunt-nosed leopard lizard (Kato and O'Farrell, 1985), and giant kangaroo rat (O'Farrell et al., 1985b), was used to develop the guidelines for identifying essential habitats or their elements during preconstruction surveys.

Blunt-nosed leopard lizards did not leave conspicuous evidence of their presence, and no specific elements of their habitat were identified as essential to their survival. Furthermore, their aboveground activities were restricted to favorable temperature and weather regimens between March and October (Tollestrup, 1979; Mullen, 1981; O'Farrell and Kato, 1980). Even when leopard lizards were active aboveground they were difficult to observe because of their cryptic coloration and defensive behavioral patterns (Mullen, 1981; O'Farrell and Kato, 1980; Kato and O'Farrell, 1985). Therefore, the goal of preconstruction surveys was to

identify washes or other generic habitats preferred by blunt-nosed leopard lizards, and to minimize construction impacts on them. In this way preconstruction surveys effectively reduced effects on blunt-nosed leopard lizards in areas where neither individual lizards nor evidence of their presence were observable.

Although the kit fox and giant kangaroo rat are nocturnal animals, preconstruction surveys for these species were conducted during daylight hours throughout the year because both construct conspicuous dens. The presence of dens provided unequivocal evidence of the use of sites by both species, and their discovery and protection became the focus of preconstruction survey efforts.

Dens are an essential component of kit fox habitat because they provide shelter from climatic extremes, protection from predators, and a safe site for raising young (Egoscue, 1956 and 1962; Morrell, 1972; Golightly, 1981). Past studies of kit fox indicated that dens were reused year after year, and that groups of dens were used exclusively by one family unit (Egoscue, 1962; Morrell, 1972, O'Farrell and Gilbertson, 1979). Importance of existing den sites was also shown by recent evidence indicating that dens were not randomly distributed throughout the habitat, but were clustered (Egoscue, 1956 and 1962; Golightly, 1981). This suggested that although habitat characteristics distinguishing existing den sites from areas without dens on NPR-1 were not yet known, suitable sites for new dens may be limited.

Multiple-entrance dens were initially considered to be more important than single-entrance dens, because existing reports indicated that the former were more frequently used by family groups, especially to raise puppies, and the latter were thought to be merely "day-use" dens occupied by individuals. Consequently, during the first years of this study 80% of the dens that were excavated because they were considered to be expendable were single-entrance dens. Although any multiple-entrance den could be used as a pupping den, additional precautions were taken to protect those dens where additional evidence (matted vegetation aprons, numerous prey remains, and fox scats) indicated that they were recently used to shelter puppies and their parents.

However, data gathered from radiotelemetry studies of kit foxes on NPR-1 indicated that single-entrance dens were more important than originally thought. Single-entrance dens used by radio-collared kit fox were sometimes enlarged to multiple-entrance dens, and therefore, had the potential of becoming future pupping dens. Based on this new information single-entrance dens were protected to the same degree as multiple-entrance dens. The policy for assessing the potential effects of construction activities on dens was altered so that all kit fox dens, regardless of the number of entrances, were conserved.

The available literature provided justification for protecting dens as part of the preconstruction survey process. It did not, however, describe any other elements of the essential habitat or life history requirements of the species that warranted or were amenable to protection. The specific effects of MER construction activities on kit fox food supplies, home range requirements, movement patterns and dispersal, sources and rates of mortality, reproductive success, and behavioral patterns were unknown. While additional studies were in progress, a temporary conservative policy was formulated to establish buffers of up to 200 yards between kit fox dens and construction sites. There was no available information to justify such wide buffers, but they were adopted to insure that foxes, their dens, and unknown essential elements of their habitat were protected from destruction or disturbance. It was hoped that additional information on the species developed from ongoing research programs would be used to develop more flexible guidelines for establishing smaller buffers that still afforded foxes with adequate protection.

As those who conducted preconstruction surveys gained more experience in conducting their tasks, and more information about the ecology of kit foxes was provided by contemporary research programs, a more reasonable approach to protecting foxes and their dens evolved. Results of live-trapping and telemetry studies failed to provide evidence that even relatively intense petroleum production activities on NPR-1 had negatively effected changes in distribution, relative abundance, activity patterns, reproduction, dispersal, or sources and rates of mortality compared with undisturbed habitats on Elk Hills. In fact, most kit foxes on NPR-1 showed a remarkable degree of adaptability to habitat disturbances and seemed to be extremely tolerant of nearby human activities (O'Farrell et al., 1985a). Results of studies of den use patterns clearly showed that foxes occupied many dens, including pupping dens, that were closer than 200 yards from major disturbances, and chronic, intense human activities as long as a high proportion of their nearby habitat was left undistrubed and they and their dens were left along.

Personnel conducting the preconstruction surveys also learned more about the construction requirements of various MER activities and what limitations there were for redesigning or relocating projects if conflicts with fox dens arose. They quickly learned that an inflexible 200-yard buffer policy was potentially self defeating because it limited the area available to relocated a proposed project. For example, a den or cluster of dens would have to be sacrificed for a construction project if existing 200-yard buffers around other dens prevented the developers from relocating the project closer than the arbitrary buffer width. Although wide buffers provided dens with extra protection, survey personnel determined that narrower buffers in conjunction with clearly marked den sites and an informed construction crew afforded much the same protection while allowing greater flexibility for locating construction activities to conserve the maximum number of den sites.

A new, more liberal policy was established that allowed Endangered Species Contractor personnel to recommend buffer widths on a site-specific basis using a series of more reasonable guidelines balanced by input from the Unit Operator's Construction Department. In relatively flat terrain a minimum buffer width of 10 yards was established to protect dens from inadvertent damage. Wider buffers were recommended to conserve dens: in areas where they were located downhill from construction sites and fill slopes might erode down on them, or on narrow ridges where excavations of one slope might expose the tunnels or chambers of a den with entrances on the other slope of the hill. Dens that appeared to be occupied by foxes when the construction activity commenced were protected by a buffer width of up to 50 yards to reduce the risk that foxes would be harmed when they were in, or traveling to and from, their den. Maintaining wider buffers between dens used to raise puppies and construction activities was particularly important. The actual width of buffers protecting dens was based on the best judgements of the preconstruction surveyor who evaluated the areal needs of the proposed construction activity, the proportion of surrounding soils and vegetation that would remain undisturbed, and the proximity, type, and occupancy of kit fox dens.

The narrower buffers required only 0.2% (10-yard buffer) to 6% (50-yard buffer) of the area protected by the early 200-yard buffers. This allowed more flexibility in locating construction projects in areas that satisfied both engineering requirements and wildlife conservation guidelines.

The development of effective guidelines and a flexible approach to endangered species protection within a major petroleum field evolved gradually, beginning in 1980. Prior to then, preconstruction surveys were not conducted on a routine basis. Also, there was a lack of understanding about the goals, responsibilities, and approaches to solving potential environmental problems between the Endangered Species Contractor and the Construction and Environmental Affairs departments of the Unit Operator. Their official working relationships and responsibilities were not clearly defined.

The Construction Department did not know which of their activities required a preconstruction survey, nor were they familiar with the specific requirements for assessing the possible effects of their activities on endangered species and their habitats.

The Endangered Species Contractor was most familiar with the life histories of the endangered species, many of their essential habitat requirements, their distributions on NPR-1, and the laws and implementing regulations associated with the Endangered Species Act. They were not knowledgeable about the program goals of the Construction Department, projected schedules for achieving MER, the specific engineering requirements of various projects including ideal locations, minimum sizes, or the standard methods used to achieve objectives on petroleum developments.

The Environmental Affairs Department was familiar with the responsibilities for achieving both construction and conservation goals. However, they were not always made aware of all proposed construction and maintenance activities that posed possible conflicts with wildlife conservation guidelines, and therefore they did not always function as an effective focal point between the Endangered Species Contractor and the Construction Department. Consequently, some projects were initiated and others were completed before endangered species preconstruction surveys were conducted.

Ultimately the success of the preconstruction survey program resulted from the establishment of a cooperative working relationship between the principal participants. The Unit Operator's Environmental Affairs Department was formally directed to act as the focal point in the preconstruction survey process. All projects that required development of previously undisturbed habitat had to be reviewed by the Environmental Affairs Department, and they determined whether a preconstruction survey was required before the project proceeded.

When a preconstruction survey was required representatives of the Endangered Species Contractor and the Construction Department worked in the field together to accomplish the task. These frequent and direct contacts between wildlife biologists and construction personnel led to improved communications between the groups, a better understanding of the required tasks, and to effective, cooperative efforts to eliminate effects of NPR-1 activities on endangered species. Direct communications allowed the wildlife biologists to develop a better understanding of the engineering and construction needs during development of an oil field, and to become more familiar with construction techniques. They were then in a better position to make reasonable and prudent recommendations for necessary alterations in project design or location to the Construction Department when conflicts with conservation of endangered species arose.

Construction personnel acquired a great deal of training in the habitat needs of the endangered species, and they learned to recognize portions of the Reserve that needed protection. They also learned by experience that compliance with conservation guidelines could be accomplished in a timely way with few major alterations in their construction sites, facility design, and schedules. Their increased knowledge about wildlife conservation allowed construction personnel to reduce the potential for inadvertent destruction of dens or other elements of endangered species' habitat.

Despite the success of the present preconstruction survey program, improvements to the process are needed in several areas. A serious flaw that weakened the effectiveness of preconstruction surveys occurred when construction activities proceeded before an endangered species survey was completed. This situation typically occurred when the Environmental Affairs Department and the Endangered Species Contractor were not notified

of proposed construction activities, or when insufficient time (e.g., less than two days) was provided between the call for a preconstruction survey and construction start-up. Although this problem was largely solved by 1984, two policies should be maintained so that the flaw does not reappear. First, improved communications between the Environmental Affairs Department and other departments which engage in construction or maintenance projects must be sustained. The Environmental Affairs Department must continue to act as the focal point for the preconstruction survey process.

Second, but perhaps more important, it is essential that sufficient time be provided in the overall construction schedule so that preconstruction surveys can be completed, and all possible alternatives considered before construction commences. Presently, input from the Endangered Species Contractor comes late in the planning of proposed projects and after a significant commitment of time and resources have been made toward completion of the project. Often, results of preconstruction surveys were reported after planning of the project was complete and construction was about to begin. Considering endangered species habitat requirements earlier in the planning process might allow projects to be designed in ways that avoid impacts to sensitive habitat elements. Earlier input would also reduce the need for costly last-minute design changes, project relocations or realignments, or delays in construction.

Effective earlier input could be accomplished by providing a specific time period for completion of a preconstruction survey prior to the establishment of construction and drilling schedules. The amount of time necessary for completing a preconstruction survey and reporting results and recommendations varies with the size of the project, but minimally requires two weeks for well-pad-size projects. Because deadlines for completion of a project would not be set, specific changes to minimize impacts could be easily accommodated. Flexibility in project design and layout will continue to be a very practical means of minimizing impacts of NPR-1 activities on endangered species.

The need to minimize the areal extent of new disturbances was identified in the Habitat Restoration Plan (O'Farrell and Mitchell, 1985), but little has been done to accomplish this goal. Although preconstruction surveys are effective in minimizing direct impacts to endangered species, changes in construction procedures will help reduce some impacts that preconstruction surveys cannot address. One method which may reduce the areal extent of new disturbances would be to use portable sumps to store drilling mud, debris, and fluids used during drilling operations. Elimination of the need to construct earthen sumps and sump roads would reduce the areal extent of impacts from construction at each well pad. Utilization of portable sumps would also reduce contamination of soils at each site from spilled drilling muds, production waste water, and oil and other toxic substances. Reducing the extent of new disturbances and elimination of contamination of soils would enhance future restoration efforts.

Another problem which preconstruction surveys cannot address is accidental damage to sensitive sites caused by poor communications or a lack of understanding on the part of equipment operators of proper procedures to follow. Although the Environmental Affairs and Construction Department personnel are aware of the proper procedures to follow for preconstruction surveys and what recommendations have been made to avoid impacts, the equipment operators actually doing the work may not be as well informed. Careful and alert action on the part of equipment operators is essential if all recommendations are to be successfully followed. An educational brochure containing information about endangered species, the reasons for conducting preconstruction surveys, how sensitive sites are marked in the field, and how to recognize habitat essential for endangered species should be made available to everyone working on NPR-1. In this way those people working on site, from land surveyors to equipment operators would minimally know know sensitive sites are identified and to avoid impacts to those sites. They may even be able to identify an essential habitat element which has not been found earlier and marked, and thus avoid damaging it.

The data collection aspect of preconstruction surveys needs two additions. First, formalized follow-up surveys of sites after construction is completed need to be conducted. Follow-up surveys will provide complete documentation needed to assess the effectiveness of preconstruction surveys by checking to see if all recommendations were accurately followed. Secondly, routine photodocumentation of a site before and after construction will provide the clearest means of recording what sensitive areas were identified during preconstruction surveys and to what degree recommendations that were made resulted in successful avoidance of impacts.

Finally, working guidelines need to be developed which will clearly define and commit personnel to appropriate tasks and responsibilities for conducting preconstruction surveys. These guidelines will allow personnel, other than the Endangered Species Contractor, to conduct preconstruction surveys on an operational basis.

5. RECOMMENDATIONS

The following recommendations are made to improve the effectiveness of preconstruction surveys in minimizing impacts of new projects on endangered species on NPR-1.

1. Proscribe construction of any projects before an endangered species preconstruction survey is completed.

2. Consider potential conflicts with endangered species earlier in the planning process of proposed projects.

3. Allow sufficient time for the completion of preconstruction surveys and formulation of recommendations before construction activities are scheduled.

4. Do not make commitments requiring completion of a proposed project until an endangered species preconstruction survey is completed and no conflicts exist.

5. Conduct follow-up surveys after completion of construction to ensure that endangered species conservation recommendations have been carried out.

6. Provide photodocumentation of project sites before and after construction.

7. Conserve all kit fox dens.

8. Develop an educational program for Unit Operator employees and subcontractors involved with construction and maintenance on NPR-1, that acquaints them with DOE's endangered species conservation program.

9. Investigate feasibility of using portable sump facilities during drilling operations.

10. Develop guidelines for conducting preconstruction surveys and transfer all survey responsibilities to the Unit Operator.

6. LITERATURE CITED

Brode, J. M., D. P. Christenson, J. Lindell, T. Charmley, R. C. Long, P. Schempf, S. Montgomery, D. Johnson, and J. Boggs. 1980. Recovery plan blunt-nosed leopard lizard, U. S. Fish and Wildlife Service, Portland, Oregon.

Egoscue, H. J. 1956. Preliminary studies of the kit fox in Utah. J. Mammal., 37:351-357.

Egoscue, H. J. 1962. Ecology and life history of the kit fox in Tooele County, Utah. Ecology, 43:481-497.

Golightly, R. T. 1981. The comparative energetics of two desert canids: the coyote *(Canis latrans)* and the kit fox *(Vulpes macrotis)*. Unpub. PhD Dissertation, Arizona State University, Tempe. 174 pp.

Grinnell, J. 1932. Habitat relations of the giant kangaroo rat. J. Mammal., 13(4):305-320.

Heady, H. F. 1977. Valley grassland. Pages 491-514 *in* M. G. Barbour and J. Major (eds.). *Terrestrial Vegetation of California*. Wiley and Sons, New York, New York.

Kato, T. T. and T. P. O'Farrell. 1985. Biological assessment of the effects of petroleum production at maximum efficient rate, Naval Petroleum Reserve #1 (Elk Hills), Kern County, California, on the endangered blunt-nosed leopard lizard *Gambelia silus*. U. S. Department of Energy, Topical Report (under review).

Madrone Associates. 1979a. Liquid products pipeline, storage and railroad facilities (Department of Energy Project 12) biological assessment San Joaquin kit fox *(Vulpes macrotis mutica)*, Naval Petroleum Reserve No. 1 (Elk Hills), Kern County, California. Final Project Report, U. S. Navy, OICC, Elk Hills, Western Division, NFEC, P. O. Box 40, San Bruno, California 94066. 80 pp.

Madrone Associates. 1979b. Liquid products pipeline, storage and railroad loading facility (Department of Energy Project 12) biological assessment blunt-nosed leopard lizard *(Crotaphytus [=Gambelia] silus)* Naval Petroleum Reserve No. 1 (Elk Hills), Kern County, California. Final Project Report, U. S. Navy, OICC, Elk Hills, Western Division, NFEC, P. O. Box 40, San Bruno, California 94066. 79 pp.

Medica, P. A. 1980. Well site survey of Elk Hills Naval Petroleum Reserve. EG&G Letter Report, Santa Barbara Operations, U. S. Department of Energy, Goleta, California. 8 pp.

Morrell, S. 1972. Life history of the San Joaquin kit fox. California Fish and Game, 58:162-174.

Mullen, R. K. 1980. Elk Hills endangered species program. Environmental assessment of the blunt-nosed leopard lizard, *Crotaphytus silus*, Phase 2, 1980. U. S. Department of Energy Topical Report, EG&G/EM Santa Barbara Operations Report Number EGG 1183-2417, 45 pp.

O'Farrell, T. P. 1980. Elk Hills endangered and threatened species program, Phase 1 Progress Summary. U. S. Department of Energy Topical Report, EG&G/EM Santa Barbara Operations Report Number EGG 1183-2403. 19 pp.

O'Farrell, T. P. 1983. San Joaquin kit fox recovery plan. U. S. Fish and Wildlife Service, Portland, Oregon. 84 pp.

O'Farrell, T. P. and L. Gilbertson. 1979. Ecological life history of the desert kit fox in the Mojave Desert of southern California. Final Report, U. S. Bureau of Land Management, Desert Plan Staff, Riverside, California. 96 pp.

O'Farrell, T. P. and T. Kato. 1980. Relationship between abundance of blunt-nosed leopard lizards, *Crotaphytus silus*, and intensity of petroleum field development in Kern County, California, 1980. U. S. Department of Energy Topical Report, EG&G/EM Santa Barbara Operations Report Number EGG 1183-2413. 41 pp.

O'Farrell, T. P., T. Kato, P. McCue, and M. L. Sauls. 1980. Inventory of San Joaquin kit fox on BLM lands in southern and southwestern San Joaquin Valley. U. S. Department of Energy Topical Report, EG&G/EM Santa Barbara Operations Report Number EGG 1183-2400. 90 pp.

O'Farrell, T. P., C. E. Harris, P. M. McCue, and T. T. Kato. 1985a. Biological assessment of the effects of petroleum production at maximum efficient rate, Naval Petroleum Reserve #1 (Elk Hills), Kern County, California, on the endangered San Joaquin kit fox, *Vulpes macrotis mutica*. U. S. Department of Energy Topical Report, EG&G/EM Santa Barbara Operations (under review).

O'Farrell, T. P., N. E. Mathews, P. M. McCue, and T. T. Kato. 1985b. Distribution of giant kangaroo rat *(Dipodomys ingens)* burrow systems on the Naval Petroleum Reserves in California. U. S. Department of Energy Topical Report, EG&G/EM Santa Barbara Operations (in preparation).

O'Farrell, T. P. and D. L. Mitchell. 1985. A habitat restoration plan for Naval Petroleum Reserve #1, Kern County, California. U. S. Department of Energy Topical Report, EG&G/EM Santa Barbara Operations (under review).

State of California. 1980. At the crossroads. A report on the status of California's endangered and rare fish and wildlife. U. S. Department of Fish and Game, Sacramento, California. 147 pp.

Tollestrup, K. 1979. The ecology, social structure, and foraging behavior of two closely related species of leopard lizards, *Gambelia silus* and *Gambelia wislizenii*. Unpub. PhD Dissertation, University of California, Berkeley. 146 pp.

U. S. Department of Energy. 1979. Petroleum production at maximum efficient rate, Naval Petroleum Reserve No. 1 (Elk Hills), Kern County, California. Final Environmental Impact Statement. DOE/EIS-0012. 493 pp.

U. S. Department of Energy. 1980. Letter of 10 April from Captain R. H. Nelson, Director, Office of Naval Petroleum and Oil Shale Reserves, to Mr. R. Kahler Martinson, Regional Manager, U. S. Fish and Wildlife Service, Portland, Oregon.

U. S. Department of the Interior. 1979. Letter of 15 June from R. Kahler Martinson, Regional Director, U. S. Fish and Wildlife Service, to Captain John I. Dick-Peddie, Officer in Charge of Construction, Naval Facilities Engineering Command, San Bruno, California.

U. S. Department of the Interior. 1980a. Letter of 1 February from R. Kahler Martinson, Regional Director, U. S. Fish and Wildlife Service, to Captain Gordon R. Gilmore, Officer in Charge of Construction, Naval Facilities Engineering Command, San Bruno, California.

U. S. Department of the Interior. 1980b. Letter of 5 June from William H. Meyer, Acting Regional Director, U. S. Fish and Wildlife Service, to Director, Office of Naval Petroleum and Oil Shale Reserves, Washington, D. C.

APPENDIX: PRECONSTRUCTION SURVEY DATA SUMMARY SHEETS OF CONSTRUCTION/DEVELOPMENT PROJECTS THAT WERE SURVEYED FOR THE PRESENCE OF KIT FOX DENS AND OTHER ENDANGERED SPECIES HABITAT

During each preconstruction survey field notes were recorded on individual data sheets. The information included on the data sheets were synthesized to provide a concise summary of all the important information gathered for each construction project.

PROJECT -- The name of each project that was surveyed for the presence of endangered species.

LOCATION -- The section number and township code for sections in NPR-1 where each project was proposed, and where preconstruction surveys were conducted. Z = T30S, R22E; R = T30S, R23E; S = T30S, R24E; B = T31S, R23E; G = T31S, R24E; M = T31S, R25E; T = T30S, R25E; H = T32S, R25E.

DATE -- The date the survey was conducted.

PERSONNEL -- The names of the persons who conducted the survey.

GENERAL HABITAT AND TOPOGRAPHY -- A general description of the habitat and topography of the land area surveyed.

CONSTRUCTION PRIOR TO PRECONSTRUCTION SURVEY -- The extent of construction that took place prior to an endangered species preconstruction survey for each project.

AREA SURVEYED -- An estimate of the land surface surveyed for each project expressed in English units.

DESCRIPTION OF METHODS -- A brief statement of how each survey was conducted.

EVIDENCE OF ENDANGERED SPECIES -- The total number of each type of kit fox den observed including: active natal, active multiple entrance, inactive multiple entrance, active single entrance, inactive single entrance, and atypical dens. Evidence of blunt-nosed leopard lizards or giant kangaroo rats, or their habitat, as well as dens of other species.

POTENTIAL CONFLICTS -- Perceived impacts to kit fox dens or to areas of potential endangered species habitat located during the survey.

ACTION -- Any action taken to reduce potential impacts to kit fox dens or other endangered species habitat. All recommendations made to the UOC Environmental or Construction departments.

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: Construction of Well Pads

Location: Townships B, R, S, G, Z, and H

Dates: November 1980 -- December 1984

Personnel: P. M. McCue, T. T. Kato, P. Medica, D. B. Hardenbrook, J. W. Johnson, J. S. McManus, B. G. Evans, P. C. Muick, C. E. Harris, and N. E. Mathews

General Habitat and Topography: Hilly terrain of NPR-1

Construction Prior to Preconstruction Survey: 88 well pad locations had construction underway or complete prior to survey.

Area Surveyed (length of pipeline, etc.): 528 acres (based on 264 surveys of approximately 2 acres each).

Brief Description of Methods: Ground transects on and around proposed sites. In 1980, 39 well pads were surveyed for the presence of endangered species after construction at the site was complete.

Evidence of Endangered Species: 141 kit fox dens located.
2 giant kangaroo rat burrows observed.
3 washes providing potential habitat for the blunt-nosed leopard lizard observed.
50 other dens located.

Potential Conflicts: 75 kit fox dens were threatened.
18 other dens were threatened.
3 washes representing potential habitat for the blunt-nosed leopard lizard were threatened.

Action:
1. Notified Unit Operator's Environmental Affairs and Construction departments of the location of 32 kit fox dens and 4 other dens to be avoided. All dens were clearly staked and flagged.
2. 18 project changes were made to avoid 27 kit fox dens and 2 other dens.
3. 13 kit fox dens and 12 other dens were excavated. 2 of the kit fox dens were culvert pipes.
4. 3 kit fox dens were accidentally buried during construction.
5. 2 project alterations avoided impacts to 2 wash habitats. An access road crossing a large wash was built, then revegetated.

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: SOZ Vapor Recovery System Tank Settings

Location: In Sections 21, 25, 26, 27, 28, 36S; 3, 6, 8, 9, 10, 11G. Sites in 25S and 26S Not Surveyed -- Construction in Progress

Dates: 6, 7, 8, 14, 20 October 1981

Personnel: J. W. Johnson and T. T. Kato

General Habitat and Topography: Not noted

Construction Prior to Preconstruction Survey: Construction was in progress at 2 sites (VT-3-25S and VT-4-26S).

Area Surveyed (length of pipeline, etc.): Total area surveyed was approximately 9.3 acres.

Brief Description of Methods: Transects walked over proposed construction site.

Evidence of Endangered Species: Fox scat observed at site VT-4-3G. 1 active single fox den at site VT-4-36S.

Potential Conflicts: Active single entrance den at VT-4-36S is not threatened by construction activities.

Action: Den at VT-4-36 clearly flagged.

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: 32S Fresh Water Tank

Location: Southeast/Southwest 32S

Dates: 17 August 1983

Personnel: J. W. Johnson

General Habitat and Topography: Disturbed hillside adjacent to tanks

Construction Prior to Preconstruction Survey: None

Area Surveyed (length of pipeline, etc.): 0.25 acre

Brief Description of Methods: Walked area among and beyond staked layout of tank pad.

Evidence of Endangered Species: None

Potential Conflicts: None

Action: None

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: 18G Free Water Knockout -- Flow Splitter Tank Pad

Location: Southeast/Northeast 18G

Dates: 26 August 1983

Personnel: J. W. Johnson

General Habitat and Topography: Gentle sloping hills

Construction Prior to Preconstruction Survey: None

Area Surveyed (length of pipeline, etc.): 3.1 acres

Brief Description of Methods: Walked tank pad and road first, then pump pad, then each line to each dehydration train separately.

Evidence of Endangered Species: 3 known telemetry dens located:

18G-29 active multiple entrance den, currently in use.

18G-1 old active multiple entrance den.

18G-5 old active multiple entrance den.

Potential Conflicts: Both 18G-1 and 18G-5 occur directly in path of water lines to dehydration trains. 18G-29 is not in jeopardy.

Action: Reroute two water lines to avoid dens 18G-1 and 18G-5.

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: 35R LPG Increased Storage Facility

Location: Section 35R (Southwest/Northeast 35R)

Dates: 16 May 1983

Personnel: N. E. Mathews

General Habitat and Topography: Rolling hills

Construction Prior to Preconstruction Survey: Construction began prior to survey; most of work complete.

Area Surveyed (length of pipeline, etc.): 7.4 acres

Brief Description of Methods: Surveyed a relatively small fill site as well as a nearby area for fill site relocation.

Evidence of Endangered Species: 4 kit fox dens located.

Potential Conflicts: 1 multiple entrance telemetry den was destroyed 35R-19-81.

Action: Location of a fill site was moved to avoid kit fox dens in the area. Informed Unit Operator's Environmental Affairs Department.

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: 35R Sump Modification and Oil/Water Separation Facility

Location: Northwest/Northeast 35R

Dates: 23 May 1983

Personnel: N. E. Mathews

General Habitat and Topography: Not noted

Construction Prior to Preconstruction Survey: Construction was complete prior to Preconstruction Survey.

Area Surveyed (length of pipeline, etc.): Site required 4.9 acres

Brief Description of Methods: Walked surrounding areas

Evidence of Endangered Species: None found

Potential Conflicts: Construction complete

Action: Informed Unit Operator's Environmental Affairs Department.

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: 27R Truck Washout Facility

Location: Southwest 27R (adjacent to 27R waste disposal area)

Dates: 19 September 1983; 9 February 1984

Personnel: J. W. Johnson and T. T. Kato

General Habitat and Topography: Gently sloping drainage area

Construction Prior to Preconstruction Survey: None

Area Surveyed (length of pipeline, etc.): 5.9 acres

Brief Description of Methods: Walk proposed area of facility

Evidence of Endangered Species: No sign of endangered species

Potential Conflicts: None

Action: None

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: 1-7R Stevens Tank Setting Vent Stack Relocation

Location: Northwest 7R

Dates: 24 May 1983

Personnel: J. W. Johnson

General Habitat and Topography: Low rounded hill adjacent to existing tank setting

Construction Prior to Preconstruction Survey: None

Area Surveyed (length of pipeline, etc.): 2.0 acres

Brief Description of Methods: Walk area to top of hill east of existing tank

Evidence of Endangered Species: None

Potential Conflicts: None

Action: None

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: 18G Storage Area

Location: Section 18G, East of 18G Tank Farm (LACT)

Dates: 19 April 1982

Personnel: T. T. Kato

General Habitat and Topography: Flat terrain. *Atriplex/Bromus* was the dominant plant association.

Construction Prior to Preconstruction Survey: None

Area Surveyed (length of pipeline, etc.): 0.7 acre

Brief Description of Methods: Walked transects over proposed site

Evidence of Endangered Species: None

Potential Conflicts: None

Action: None. Project subsequently suspended

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: Waterflood System: 33S Central Pumping Plant

Location: Section 33S

Dates: 27 April 1981

Personnel: P. C. Muick

General Habitat and Topography: Hilly terrain of NPR-1

Construction Prior to Preconstruction Survey: Construction almost completed prior to survey.

Area Surveyed (length of pipeline, etc.): Site required 6.9 acres

Brief Description of Methods: Transects walked around construction site

Evidence of Endangered Species: 2 kit fox dens found:
Active multiple-entrance kit fox telemetry den 4G-3-80
Active single-entrance kit fox den 4G-13-81

Potential Conflicts: Site under construction prior to complete endangered species survey. Dens apparently not threatened by construction.

Action: None

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: Waterflood System: 18G Pipeline Booster Pad

Location: Section 18G

Dates: 10 July 1981

Personnel: J. S. McManus and J. W. Johnson

General Habitat and Topography: Not noted

Construction Prior to Preconstruction Survey: None

Area Surveyed (length of pipeline, etc.): Approximately 2.5 acres

Brief Description of Methods: Transects spaced at 10 yard intervals over the proposed project site.

Evidence of Endangered Species: None

Potential Conflicts: None

Action: None

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: Waterflood System: Pilot Waterflood Project

Location: Sections 35S; 2, 3G

Dates: 19 June 1981

Personnel: P. C. Muick and J. S. McManus

General Habitat and Topography: Hilly terrain of NPR-1

Construction Prior to Preconstruction Survey: None

Area Surveyed (length of pipeline, etc.): 40.8 acres

Brief Description of Methods: 2 observers walked proposed pipeline route.

Evidence of Endangered Species: 1 active multiple-entrance den, 3G-1-81
1 active single-entrance den in Section 2G

Potential Conflicts: Den 3G-1-81 located approximately 20 yards from pipeline. Den apparently not threatened by construction.

Action: None

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: Waterflood System: Source Well Gathering Line

Location: Sections 13, 14B; 4, 5, 8, 17, 18G; 33S

Dates: 28, 29, 30 April 1981; 4, 5 May 1981

Personnel: T. T. Kato, J. S. McManus, P. M. McCue, P. C. Muick, and B. G. Evans

General Habitat and Topography: Buena Vista Valley and the hilly terrain of NPR-1

Construction Prior to Preconstruction Survey: None

Area Surveyed (length of pipeline, etc.): 117.3 acres

Brief Description of Methods: 2 observers walked proposed pipeline route surveying approximately 25 yards on each side of centerline.

Evidence of Endangered Species: 1 active single-entrance den in Section 4G within pipeline right-of-way
1 active multiple-entrance den in Section 17G near stake marked PL 17GA

Potential Conflicts: Active single-entrance den in 4G threatened by construction. Den in 17G not threatened by construction.

Action: Den in Section 4G excavated.

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: Waterflood System: West Main Body B -- Main Distribution Pipeline

Location: Sections 30, 31, 32, 33S; 23, 25, 26, 35, 36R; 4, 5, 6G

Dates: 9, 24, 27 July 1981

Personnel: J. W. Johnson, J. S. McManus, P. C. Muick, and D. E. Hardenbrook

General Habitat and Topography: Hilly terrain of NPR-1

Construction Prior to Preconstruction Survey: None

Area Surveyed (length of pipeline, etc.): 224.8 acres

Brief Description of Methods: 2 observers walked proposed pipeline route.

Evidence of Endangered Species: Kit fox dens 26R-5-81, 36R-3-81, and 36R-13-81 found during survey. Dens 26R-5 and 36R-3 are radiotelemetry dens. 1 atypical den found near PI139 in Section 36R. 2 possible inactive dens in Section 33S near PI 194 and PI 195. Inactive dens near top of ridge east of well 28-29S.

Potential Conflicts: Dens 26R-5-81, 36R-3-81, and 36R-13-81 possibly threatened by construction. Den 25R-5-81 approximately 55 yards south of proposed pipeline route.

Action: Dens 26R-5-81, 36R-3-81, and 36R-13-81 staked and flagged.

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: Waterflood System: East Main Body B -- Main Distribution Pipeline

Location: Sections 33, 34, 35S; 3, 4G

Dates: 11, 21 May 1981

Personnel: P. C. Muick, T. T. Kato, J. S. McManus, and B. G. Evans

General Habitat and Topography: Hilly terrain of NPR-1

Construction Prior to Preconstruction Survey: None

Area Surveyed (length of pipeline, etc.): 95.1 acres

Brief Description of Methods: 2 observers walked on either side of proposed pipeline centerline.

Evidence of Endangered Species: Active pupping den found 100+ yards from pipeline in Section 34S. 1 inactive single entrance den found approximately 75 yards south of pipeline in Section 4G.

Potential Conflicts: Dens not threatened by construction. Proposed pipeline route would impact a small mammal trapping area (D-Line) in Section 33S and a wildlife oasis in Section 3G.

Action: Pipeline rerouted to avoid small mammal trapping area in 33S and wildlife oasis in 3G.

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: Waterflood System: East and West Main Body B -- Lateral Lines

Location: Sections 2, 3, 4, 5, 6G; 31, 32, 33, 34, 35S;
23, 24, 25, 26, 36R

Dates: 22, 23, 29 October 1981; 19 November 1981;
1, 2, 8, 9, 16, 17, 22, 28 December 1981

Personnel: D. B. Hardenbrook, B. G. Evans, J. S. McManus,
J. W. Johnson, and T. T. Kato

General Habitat and Topography: Hilly terrain of NPR-1

Construction Prior to Preconstruction Survey: Construction was complete or underway at 8 locations

Area Surveyed (length of pipeline, etc.): 66.1 acres

Brief Description of Methods: 1 observer walked proposed pipeline route.

Evidence of Endangered Species: Kit fox dens were found at 4 locations:

383-25R: 1 active multiple-entrance kit fox den

372-33S: 1 active multiple-entrance kit fox den

351-6G: Active multiple-entrance erosion gully kit fox den#6G-19-81

342-6G: 2 active multiple-entrance kit fox dens #6G-13-81 and 6G-20-81

Potential Conflicts:

383-25R: Construction complete prior to survey.

372-33S: Den approximately 3 yards from proposed route, will be impacted.

351-6G: Den threatened by construction.

342-6G: Dens threatened by construction.

Action:

372-33S: Pipeline route changed to avoid den.

351-6G: Den 6G-19-81 excavated prior to construction.

342-6G: Dens staked and flagged. Construction activities directed to avoid dens.

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: Waterflood System: Electrification of Water Source Wells

Location: Sections 13, 14B; 18G

Dates: 21 July 1981

Personnel: J. S. McManus and D. B. Hardenbrook

General Habitat and Topography: Low relief to flat areas in Buena Vista Valley

Construction Prior to Preconstruction Survey: None

Area Surveyed (length of pipeline, etc.): 21.6 acres

Brief Description of Methods: Walked proposed powerline route

Evidence of Endangered Species: 1 active multiple-entrance den 18G-13-81, located approximately 8 yards Northeast of stake for proposed route.
NOTE: *Dipodomys ingens* burrow systems found in Sections 13B, 17G, and 18G.

Potential Conflicts: Active multiple den possibly threatened by construction. 1 entrance caved in by survey party vehicle.

Action: Not noted

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: Waterflood System: Northwest "R" 17R Booster Station

Location: Section 17R, Northwest of Well 371-17R

Dates: 15 July 1981

Personnel: B. G. Evans and J. W. Johnson

General Habitat and Topography: Low relief hills

Construction Prior to Preconstruction Survey: None

Area Surveyed (length of pipeline, etc.): Approximately 8.5 acres

Brief Description of Methods: Transects oriented north-south over pad area. Road routes surveyed along staked corridors.

Evidence of Endangered Species: None

Potential Conflicts: None

Action: None

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: Waterflood System: Northwest "R" Pipeline from 33S Central Plant to 17R Booster Station

Location: Sections 30, 31, 32, 33S; 16, 17, 22, 23, 25, 26R

Dates: 5, 6, 11 August 1981

Personnel: P. C. Muick, J. W. Johnson, B. G. Evans, D. B. Hardenbrook, and J. S. McManus

General Habitat and Topography: Hilly terrain of NPR-1

Construction Prior to Preconstruction Survey: None

Area Surveyed (length of pipeline, etc.): 148.2 acres

Brief Description of Methods: 2 observers walked the proposed pipeline route surveying approximately 25 yards on each side of centerline.

Evidence of Endangered Species: 2 active multiple entrance dens found, 23R-1-81 and 25R-7-81.
NOTE: 1 *Dipodomys ingens* burrow system found in Northwest/Southeast 32S.

Potential Conflicts: Den 23R-1-81 located approximately 1 yard south of centerline. Den 25R-7-81 located approximately 5 yards south of centerline. Both dens threatened by construction activities.

Action: Both dens excavated prior to construction.

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: Waterflood System: Northwest "R" Distribution Pipeline

Location: Sections 7, 8, 9, 10, 15, 16, 17, 18R

Dates: 17 February 1982

Personnel: B. G. Evans, J. S. McManus, P. M. McCue, and T. T. Kato

General Habitat and Topography: Rolling hills; *Atriplex polycarpa* and *Bromus rubens* was the dominant plant association.

Construction Prior to Preconstruction Survey: None

Area Surveyed (length of pipeline, etc.): 174.1 acres

Brief Description of Methods: 2 observers walked the proposed pipeline route surveying approximately 25 yards on each side of the centerline.

Evidence of Endangered Species:

Section 7R: 1 active multiple-entrance den approximately 30 yards south of centerline

Section 15R: 2 active multiple-entrance dens, 1 on the proposed route, 1 approximately 8 yards from centerline. 1 active single entrance den approximately 4 yards from centerline.

Section 16R: 2 active single-entrance dens, both approximately 10 yards from centerline.

Section 17R: 1 active single-entrance den approximately 4 yards from centerline.

Potential Conflicts: Dens in Sections 15R and 17R threatened by construction activity. Dens in Sections 7R and 16R not threatened by construction.

Action:

Section 15R: Pipeline route changed to avoid den on centerline. Construction activity directed around den located 8 yards from centerline, and active single entrance den excavated prior to construction.

Section 17R: Pipeline route changed to avoid den located 4 yards from centerline. All den locations staked and flagged and their locations reported to construction personnel.

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: Waterflood System: Northwest "R" Lateral Lines

Location: Sections 7, 8, 17, 18R

Dates: 30, 31 March 1982

Personnel: P. M. McCue

General Habitat and Topography: Not noted

Construction Prior to Preconstruction Survey: None

Area Surveyed (length of pipeline, etc.): 15 lateral line routes surveyed -- length not available

Brief Description of Methods: 1-person transects along proposed route; surveyed approximately 50 yard width.

Evidence of Endangered Species: None

Potential Conflicts: None

Action: None

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: Waterflood System: Northwest "R" Powerline

Location: Sections 16, 17, 21, 27, 28, 34, 35R

Dates: 5, 10, 12 November 1981

Personnel: J. W. Johnson, J. S. McManus, and D. B. Hardenbrook

General Habitat and Topography: Rolling to steep hills

Construction Prior to Preconstruction Survey: None

Area Surveyed (length of pipeline, etc.): 103.7 acres

Brief Description of Methods: 1- and 2-person transect surveys; transect width of 25 yards each side of centerline.

Evidence of Endangered Species: 1 active multiple kit fox den found.
1 active single possible kit fox den found.

Potential Conflicts: Active multiple-entrance den not threatened. Active single-entrance den possibly threatened by construction (approximately 2.5 yards from proposed line).

Action: *Atriplex* near active single den flagged.

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: Cathodic Protection of Wells Phases I through VI

Location: Townships S, G, R, B, A; see Figure 6, Page 29

Dates: August-November 1981

Personnel: T. T. Kato, J. S. McManus, B. G. Evans, D. B. Hardenbrook, and J. W. Johnson

General Habitat and Topography: Hilly terrain of NPR-1

Construction Prior to Preconstruction Survey: Construction was complete or underway for Phases I and II.

Area Surveyed (length of pipeline, etc.): Approximately 783.6 acres

Brief Description of Methods: Walk proposed powerline and waterline routes.

Evidence of Endangered Species: 42 kit fox dens found

Potential Conflicts: 8 threatened kit fox dens. Construction underway prior to survey for Phases I and II.

Action: 37 den sites flagged. 1 powerline was rerouted to avoid 3 kit fox dens. Recommended that drilling debris from an anode not be discarded near one den. Recommended using existing roads rather than constructing a new road to a rectifier.

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: Electrification of SOZ Wells Summary

Location: Sections 19, 28, 29, 30, 32, 33, 34, 36S;
2, 3, 16, 17G; 19, 27, 29, 30, 32, 33, 34R; 24Z

Dates: 3, 12, 18 November 1981; 1, 7, 10, 14, 28 December 1981;
4, 5 January 1982

Personnel: J. S. McManus, B. G. Evans, D. B. Hardenbrook,
J. W. Johnson, and T. T. Kato

General Habitat and Topography: Hilly terrain of NPR-1

Construction Prior to Preconstruction Survey: Construction was complete at 2 sites

Area Surveyed (length of pipeline, etc.): 143.3 acres

Brief Description of Methods: Proposed powerline routes surveyed.

Evidence of Endangered Species: 11 kit fox dens found:
2 active natal
5 active multiple
3 active single
1 active single-entrance dens

Potential Conflicts: Dens not threatened by construction activity.

Action: None

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: Seismic Survey, Spring 1982

Location: Sections 16, 17, 19, 20, 22, 25, 27, 29, 30, 31, 32, 34, 35, 36S; 1, 2, 3, 6, 8, 9, 10, 11, 12G; 6M; 31T

Dates: 20, 26, 27, 29 April; 17, 18, 24 May 1982; 7 June 1982

Personnel: D. B. Hardenbrook, B. G. Evans, P. M. McCue, M. L. Sauls, and T. T. Kato

General Habitat and Topography: Flat to hilly terrain of NPR-1

Construction Prior to Preconstruction Survey: None

Area Surveyed (length of pipeline, etc.): 247 acres

Brief Description of Methods: 1 observer walked proposed seismic line route or drove along road if proposed route followed existing road.

Evidence of Endangered Species: 2 pupping dens and 2 inactive multiple-entrance dens found. Occupied pupping den is 8G-27-82. 1 blunt-nosed leopard lizard observed on line through 15G. 15G is not on NPR-1 property.

Potential Conflicts: None of the dens should be impacted if activity is confined to proposed route.

Action: Den areas staked and flagged to prevent accidental damage.

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: Seismic Survey Northwest "R"

Location: Sections 7R; 13, 23, 24Z

Dates: November 1982

Personnel: T. T. Kato

General Habitat and Topography: Rolling hills

Construction Prior to Preconstruction Survey: None

Area Surveyed (length of pipeline, etc.): 38.3 acres

Brief Description of Methods: Walked proposed seismic survey route.

Evidence of Endangered Species: 1 inactive den found on centerline of proposed route.

Potential Conflicts: Den potentially threatened by seismic survey.

Action: Den area staked and flagged. Survey crew chief notified of den location. Route changed to avoid den.

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: Seismic Survey 14, 24Z

Location: Sections 14, 24Z; from Northwest Corner of 14Z to Southeast Corner of 24Z

Dates: 21, 22 February 1984

Personnel: T. T. Kato and J. W. Johnson

General Habitat and Topography: Low rolling hills; dominant vegetation was *Atriplex polycarpa*, and *Bromus rubens*.

Construction Prior to Preconstruction Survey: None

Area Surveyed (length of pipeline, etc.): 89.5 acres

Brief Description of Methods: Each route was walked by 1 observer.

Evidence of Endangered Species: No sign of endangered species. 11 badger dens were found.

Potential Conflicts: Kit fox using badger dens could be buried by cave-in of den by vehicle.

Action: Badger den areas indicated with pink flagging so seismic survey vehicles would avoid impacting the dens.

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: 1984 Northwest "R" Seismic Survey

Location: Sections 12, 13, 23Z; 7R

Dates: 9 April 1984

Personnel: B. T. Kelly and J. W. Johnson

General Habitat and Topography: Rolling slopes to flats dominated by *Bromus rubens*, and *Atriplex polycarpa*.

Construction Prior to Preconstruction Survey: None

Area Surveyed (length of pipeline, etc.): 231 acres

Brief Description of Methods: Walk clearly staked route of proposed seismic survey.

Evidence of Endangered Species: 1 inactive multiple-entrance kit fox den observed on northern line near flag #223.3. Several sandy washes appear suitable for blunt-nosed leopard lizard. 1 inactive multiple-entrance coyote den. 1 den used by burrowing owl. Numerous badger holes observed.

Potential Conflicts: None

Action: 13 April 1984 met with NORPAC's field party manager to discuss seismic survey methods to assess the effectiveness of the endangered species survey.

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: Seismic Survey 6M

Location: Sections 5, 6M

Dates: 16 May 1984

Personnel: T. T. Kato

General Habitat and Topography: Gently rolling hills dominated by *Atriplex polycarpa*, and *Bromus rubens*.

Construction Prior to Preconstruction Survey: None

Area Surveyed (length of pipeline, etc.): 14.9 acres

Brief Description of Methods: 1 person walked the staked and flagged proposed seismic survey route.

Evidence of Endangered Species: No kit fox dens. 4 single-entrance unidentified dens located. Barn owl nest observed.

Potential Conflicts: All single entrance dens were within 10 yards of proposed seismic survey route.

Action: The seismic survey route was slightly changed near each of the 4 dens to avoid possible impacts to the dens.

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: South Flank of NPR-1 Security Fenceline

Location: Sections 24, 25Z; 30, 32R; 4, 10, 11, 12, 13B; 18G

Dates: 19, 20 May 1982

Personnel: D. B. Hardenbrook, P. M. McCue, and M. L. Sauls

General Habitat and Topography: Rolling to steep ridges with drainage systems leading to the southwest.

Construction Prior to Preconstruction Survey: None

Area Surveyed (length of pipeline, etc.): 103.1 acres

Brief Description of Methods: 1-person surveys for segments of fenceline.

Evidence of Endangered Species: 3 active multiple entrance telemetry dens: 35R-5-82; 12B-8-82; 10B-4-80.
9 possible kit fox dens:
7 inactive multiple entrance dens.
2 inactive single entrance dens.
6 badger dens.

Potential Conflicts:
1. None on fenceline
2. Unable to anticipate disturbances from access to fence area from Buena Vista Road by construction personnel.

Action: 17, 18 February 1983
1. Clearly flagged 3 telemetry dens and 1 inactive multiple, 4-entrance possible kit fox den in areas near fence.
2. One 5-entrance inactive multiple entrance den was determined to be merely incomplete digs of rodent holes. This den was excavated.
3. No further action was taken on remaining dens.

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: Fire Break Along the South Flank of the Security Fenceline

Location: Sections 25Z; 30, 32R; 4, 10, 11, 12, 13B; 18G

Dates: 17, 18, 19 May 1983

Personnel: J. W. Johnson and N. E. Mathews

General Habitat and Topography: Rolling to steep ridges with drainage systems leading toward the southwest.

Construction Prior to Preconstruction Survey: 2 miles of the firebreak was disced prior to a survey

Area Surveyed (length of pipeline, etc.): Approximately 180 acres

Brief Description of Methods: 2-person survey walking areas having potential for construction of firebreak along fence.

Evidence of Endangered Species: Total of 33 dens located: 13 badger, 9 kit fox, 6 coyote, and 5 unknown. 30 washes potentially providing blunt-nosed leopard lizard habitat were identified.

Potential Conflicts: 5 known multiple-entrance kit fox telemetry dens within close proximity to fenceline in danger of destruction. 30 washes will be crossed potentially impacting blunt-nosed leopard lizard habitat.

Action: Construction of the firebreak along the south flank security fence was halted. Existing firebreak along NPR-1 boundary was maintained instead.

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: Segment of SOZ Gas Gathering Pipeline

Location: Pipeline Followed Existing Pipeline Corridor from 18G to 32S.

Dates: 9 December 1983

Personnel: J. W. Johnson and T. T. Kato

General Habitat and Topography: Hilly terrain and large wash

Construction Prior to Preconstruction Survey: None

Area Surveyed (length of pipeline, etc.): Approximately 34 acres

Brief Description of Methods: 1-person surveys along proposed pipeline route.

Evidence of Endangered Species: 3 kit fox telemetry dens: active multiple-entrance dens 5G-18-81, 18G-31-83, and 5G-11-80. 1 kit fox natal den 5G-27-83.

Potential Conflicts: Den 5G-18-81 located under existing pipes within pipeline corridor, but is also protected from pacts.

Action: Den 5G-18-81 is permanently marked. Informed Unit Operator's Environmental Affairs and Construction departments personnel of the locations of dens.

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: LNG Pipeline (ARCO)

Location: Sections 35, 36R; 31, 32, 33, 34, 35, 36S; 31T

Dates: 10, 12, 18, 19 August 1981

Personnel: T. T. Kato, J. S. McManus, B. G. Evans, J. W. Johnson, and P. M. McCue

General Habitat and Topography: Rolling to steep hills near the central ridge of Elk Hills

Construction Prior to Preconstruction Survey: None

Area Surveyed (length of pipeline, etc.): 154 acres

Brief Description of Methods: 2 observers walked on each side of the proposed centerline route surveying approximately 25 yards out from centerline. A previous aerial survey was unsuccessful.

Evidence of Endangered Species: 4 kit fox dens found:
1 inactive natal den: 36R-11-81
2 active multiple-entrance dens: 31S-13-81 and 31S-14-81
1 active single-entrance den: 31S-12-81

NOTE: 2 *Dipodomys ingens* burrow systems found.

Potential Conflicts: The inactive natal, 1 active multiple-entrance, and the active single-entrance dens would be impacted by construction of the pipeline. 1 active multiple-entrance den was approximately 40 yards south of the proposed centerline, not threatened by project.

Action: Pipeline changed to avoid inactive natal den. Project subsequently suspended -- not further action.

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: 8-Inch Low Pressure Natural Gas Line -- Section 33R

Location: Tank Setting 1-33R

Dates: 22 June 1984

Personnel: J. W. Johnson

General Habitat and Topography: South-facing slopes of a drainage. Vegetation includes: *Atriplex polycarpa*, *Hymenoclea salsola*, *Isomeris arborea*, and *Bromus rubens*.

Construction Prior to Preconstruction Survey: None

Area Surveyed (length of pipeline, etc.): 1.4 acres

Brief Description of Methods: Walk staked pipeline route surveying about 30 feet on either side of the line.

Evidence of Endangered Species: None

Potential Conflicts: None

Action: Explored the possibility of installing the pipeline along the route of nearby existing pipelines, but there was insufficient available space to install the pipeline there.

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: Powerline to Trailer Offices at the 11G Main Gate

Location: Main 11G Gate

Dates: 15, 21 June 1984

Personnel: J. W. Johnson

General Habitat and Topography: Rolling hills dominated by *Atriplex polycarpa* and *Bromus rubens*.

Construction Prior to Preconstruction Survey: None

Area Surveyed (length of pipeline, etc.): 10.9 acres

Brief Description of Methods: Walk proposed powerline route as well as 2 alternate routes, surveying approximately 30 feet on either side of line.

Evidence of Endangered Species: Proposed route: multiple-entrance kit fox den 11G-6-84 and multiple-entrance kit fox den 11G-7-84 were located.
Alternate "B": multiple-entrance kit fox den 12G-1-84 and multiple-entrance kit fox den 12G-2-84 were located.
Alternate "A": 1 badger dig and one unidentified inactive multiple-entrance den were located.

Potential Conflicts: Possible impacts to kit fox dens existed for the proposed route and alternate route B.

Action: Recommended that powerline construction follow alternate route A. However, due to topographical considerations, alternate route B was selected. Kit fox den 12G-1-84 was clearly staked and flagged, to avoid any accidental impacts to the den during construction.

PRECONSTRUCTION SURVEY SUMMARY SHEET

Project: Buried Gas Pipeline

Location: Sections 35R; 2, 11, 14, 23, 26, 35B

Dates: Constructed October 1981

Personnel: No survey

General Habitat and Topography: Rolling hills to flat valley.

Construction Prior to Preconstruction Survey: Project complete without a preconstruction survey.

Area Surveyed (length of pipeline, etc.): None

Brief Description of Methods: No survey

Evidence of Endangered Species:

Potential Conflicts:

Action:

DISTRIBUTION

U. S. Department of Energy,
Naval Petroleum Reserves in
California, Tupman, California

J. W. Lagler, Director (50)

USDOE, Office of Naval Petroleum
and Oil Shale Reserves,
Washington, D.C.

Capt. M. E. Smith, Jr., Director
Major B. R. Lenz
D. Silawsky

USDOE, Office of Health and
Environmental Research,
Washington, D. C.

H. McCammon
R. L. Watters
W. S. Osburn, Jr.

USDOE, Nevada Operations Office
Las Vegas, Nevada

F. E. Bingham
G. M. Plummer

U. S. Department of the Interior,
Fish and Wildlife Service,
Portland, Oregon

R. G. Swanson

USDI, FWS, Sacramento, California

G. C. Kobetich
T. Rado

USDI, Bureau of Land Management,
Sacramento, California

M. Ferguson
R. Olendorff

USDI, BLM, Bakersfield,
California

T. Salt
L. Saslaw
G. Sheppard

California Department of Fish
and Game, Sacramento, California

J. Gustafson

EG&G/EM, Santa Barbara Operations

W. Berry
H. M. Borella
E. Collins
L. A. Franks
J. W. Gehring
C. E. Harris
J. W. Johnson
T. T. Kato
T. P. O'Farrell
N. Sigler
M. Spencer
M. Wolfe
B. Zoellick
Publications